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BIRD-BANDING

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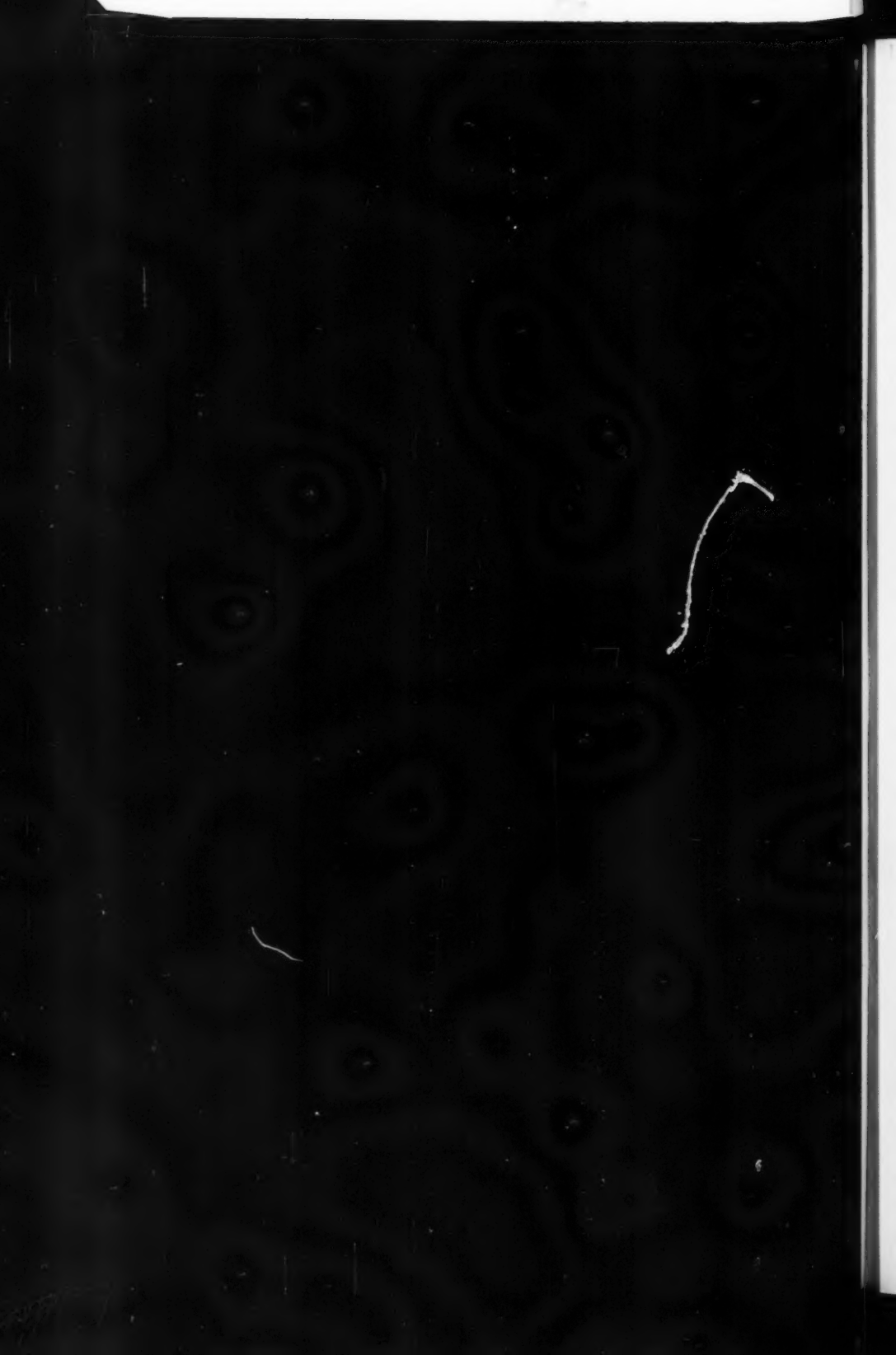

BIRD-BANDING

A JOURNAL OF ORNITHOLOGICAL INVESTIGATION

Vol. XXX January, 1959 No. 1.

THE BREEDING BEHAVIOR OF THE PAINTED BUNTING IN SOUTHERN OKLAHOMA

By DAVID F. PARMELEE

The Painted Bunting *(Passerina ciris)* is so intimately a part of the avifauna of southeastern United States that many ornithologists are surprised to find it as common in more western parts of its range [The A. O. U. Check-List (1957: 554) states that it breeds as far west as New Mexico, Texas, and parts of Mexico]. In south-central Oklahoma it is among the very commonest of passerine birds. Its great abundance in Marshall County near the north shore of Lake Texoma has been well known to investigators working at the University of Oklahoma Biological Station since its establishment there in 1950. This study deals chiefly with the population of Painted Buntings on or near the station from June 15 to August 9, 1957.

The original plan was to determine whether the subadult male of the species bred. In 1957, the number of subadult males in the population observed was very small. The number of fully adult males, on the other hand, was unexpectedly high. Consequently, the project changed to one concerned with the breeding behavior of adult buntings, particularly with the role played by each sex at the nest and in care of young.

The project started too late in the season to include spring arrival of the buntings. Records (Baumgartner and Howell, 1947: 58; Nice, 1931: 176; Norman, unpubl. notes; Sutton, unpubl. notes) show that the species arrives at Oklahoma in late April. The earliest known arrival date of April 17 is for Custer County, located west-centrally in the state (Nice, *ibid.*). The earliest arrival date for Marshall County is April 19; but apparently the species does not arrive there in force until the very last of April and the first of May (Sutton, *ibid.*).

It is not certain which sex arrives first, or if the sexes arrive simultaneously. Many April records are of singing males. The earliest known arrival date of a female is April 30 (Sutton, *ibid.*), this having been recorded for Cleveland County in the central part of the state. Earlier arrival dates may have been of either females or subadult males in female-like plumage. Territorial disputes occurred as early as May 5 in Cleveland County (Sutton, *ibid.*), and a full clutch of eggs was found as early as May 23 in Muskogee County in northeast Oklahoma (Norman, *ibid.*). In South Carolina, male Painted Buntings "always come first, followed in about a week by the females" (Sprunt and Chamberlain, 1949: 515).

In 1957, nesting of the Painted Bunting in Marshall County was well under way by mid-June. However, some early phases of the breeding cycle, e.g., courtship and nest construction, were continued

even into July. This repetition was due in part to excessive predation caused by flood waters which concentrated predators, and in part to double-broodedness. We never did see, or interpret as such, the actual establishment of a nest territory—the nesting area defended by the male against other males of the species. Those that had been established early in the season apparently were maintained until the end of nesting. The first egg of a clutch was found June 9 on the station grounds (by D. H. Baepler). A juvenile estimated to be 23 days old was collected several miles northwest of the station on June 24, indicating that egg-laying started sometime in mid-May. Except for a female seen leaving an inaccessible nest that possibly had eggs or young during May 26-28 (Sutton, *ibid.*), there are no earlier dates of egg-laying for any year in Marshall County, so far as known.

We found the Painted Bunting common in scattered strips of woodland between open or partially overgrown fields, and along wooded, often very deep gullies that led to Lake Texoma. Thinly wooded fringe along county roads was also favored by the buntings. There male after male on territory sang from telephone wires and tree perches close to the road. Buntings were less numerous in the larger groves and forested areas where their numbers noticeably decreased from the forest ecotone to the dense interior. They thrived in primarily agricultural areas where some land was feral; in this respect recently abandoned farms provided optimal conditions. This was not always so. Two pairs of buntings even invaded the station grounds where large buildings and extensive kept lawns with exotic shrubs created a pronounced artificial environment. In all these habitats only the Mockingbird *(Mimus polyglottos)*, Orchard Oriole *(Icterus spurius)*, Brown-headed Cowbird *(Molothrus ater)*, Cardinal *(Richmondena cardinalis)*, and Lark Sparrow *(Chondestes grammacus)* appeared to be as common as the bunting.

Nest territories invariably had several things in common, namely: (1) enough vegetation, though it be but a single tree or small bush, to support and conceal the nest; (2) several singing perches for the male; (3) a feeding ground, usually a grassy field with scattered shrubs (see Fig. 1). We determined territorial boundaries by plotting points where skirmishes between males took place, and by employing dummy males which were attacked unhesitatingly by defending males on territory. One carefully studied territory was 75 by 180 yards, somewhat rectangular in shape. Several other territories studied were about this size. They also appeared rectangular in shape, perhaps a result of the artificial sectioning of the land by roads, groves, fields, etc.

At no time were trespassing males tolerated. Disputes were common, and there was much chasing by males; but displays closely resembling courtship displays also took place. Males approached within inches of each other, and sometimes one of them assumed a peculiar, very stiff stance, thrusting his head up and back and his tail up and forward. Then he fluttered his wings, at times violently; often he kept his bill wide open. Above ground this posture was maintained even vertically —with front end down. Holding fast to his perch, he leaned far forward, parrot-like, toward his adversary, followed by vicious attacks. At times two birds faced each other with open bills, and suddenly they

spiraled straight up from the ground for several feet, dealing blows the whole while. No cripples resulted from the skirmishes we witnessed; but there can be no doubt that real animosity existed. Many times the dummy was struck hard by irate males. Having first knocked the dummy from its perch, some males even followed it to the ground and attacked again. One dummy was thus literally defeathered and picked apart.

The over-all shape of the species, the various postures it assumes while perching, and its movements in general probably evoke little or no response, other than to call attention, in males on territory. The dummies were flat, shapeless, simply cotton filled skins. Regardless of how placed, even upside down, they were attacked unhesitatingly. Moreover, the dummies were motionless. Colors, more likely combinations of colors, probably elicited the responses, but we failed to isolate which colors were indispensable. The buntings did not attack cards of a single color or combinations of colored cards, and for this reason some depth or shape, within limits, seemed important. Very noticeable were the bright eye-rings of the males when they displayed before either sex. At such times these feathers appeared elevated. We did not, however, experiment specifically with the eye-ring. The dummies were invariably attacked by defending males, and usually repeatedly. Sometimes the dummies went unseen by the males for

Fig. 1. Painted Bunting habitat in southern Oklahoma. Adult buntings on territory commonly gather insects for their young in feral fields such as shown in this picture. Photographed August 9, 1957, by Donald H. Baepler.

considerable periods. This was especially true, interestingly enough, when the dummy was placed within a few feet of the nest.

Only once did we see a female attack an adult male, dummy or otherwise. This happened when a dummy was placed near her nest with large young. Both she and her mate together repeatedly attacked the dummy above and on the ground. When the dummy was replaced with a subadult male dummy, the male parent was much interested, approached it closely from the side, above, and below, but did not fly at and strike it. The female likewise looked it over carefully, then suddenly stiffened, fluttered her wings, and struck with full fury. Only then did the male join the attack.

We succeded in trapping adult males only by baiting a live trap with other adult males, either genuine or dummy. On the other hand, we succeeded in trapping females only by baiting with a fledgling. Our use of mist nets was not at all effective in catching buntings of either sex. Trapping activities and field observations, use of both live and dummy birds, convinced us that trespassing males were attacked by males, seldom by females, and that trespassing females were tolerated by both sexes, even in the nest-tree itself. Since we did not possess live subadult males, we did not reach any satisfactory conclusion concerning them.

Only once did we see a bunting chase another species of bird on or off territory. In this case, a male struck and drove off a Downy Woodpecker *(Dendrocopos pubescens)* that had alighted near the bunting's nest. Only once did we see another species—a Great Crested Flycatcher *(Myiarchus crinitus)*—chase a bunting. The Mourning Dove *(Zenaidura macroura)*, Yellow-billed Cuckoo *(Coccyzus americanus)*, Scissor-tailed Flycatcher *(Muscivora forficata)*, Mockingbird, Brown Thrasher *(Toxostoma rufum)*, Bell's Vireo *(Vireo bellii)*, Orchard Oriole, Cardinal, Blue Grosbeak *(Guiraca caerulea)*, Lark Sparrow, and Field Sparrow *(Spizella pusilla)*, often nested close to the buntings. Indeed, many of these birds were tolerated in the nest-tree of buntings.

Courtship was not practiced daily by the buntings, and, consequently, we saw displays only infrequently. It occurred mainly, if not solely, during pair formation (or attempts at pair formation), during the period immediately preceding egg-laying, and during egg-laying. At these times the males chased females on and off territory. Several males frequently became involved in these chases, causing overlap of courtship and territorial defense. Courtship often took place on the ground in fields and frequently along roadsides or on the road itself, and not necessarily near the nest when one was present.

The usual, perhaps essential, display of the male was one of hopping about in a circling manner close to the female. With body held low on flexed legs, he stretched his neck, at times lifted his head up and back, and invariably fluttered his wings. One male, observed in Tulsa County (Norman, *ibid.*), circled a female counterclockwise, and while doing so, extended his right wing vertically high above his back, then, extended both wings horizontally. Continuing hopping, he again extended vertically his right wing, and, finally, resumed a fluttering wing display. Another display not seen by us took place in Marshall County in 1952. There a male fluttered in mid-air, "treading in absolutely

one spot," before a female (Sutton, *ibid.*). A most remarkable display was seen by us, but only once. As a female flew low over a field, a male suddenly darted in front of her, and, while flying forward, spread his tail, elevated his head, and manipulated his wings in such a manner that they appeared to be fluttering in flight. Very noticeable were the bright colors of the male's upperparts—kept in full view of the female following close behind. This flight display covered nearly 30 yards!

During the male's display, the female often assumed no special attitude, oftentimes ignoring the male by pecking at objects on the ground. When serious, she crouched with head tilted back and tail up and forward. This position invited copulation, the male mounting from above. Courtship was not always followed by copulation, which appeared not to be an essential part of the courtship display. According to our observations, copulation occurred just before and during egg-laying, and at no other time; but this is problematical.

One adult male displayed before a juvenile. This bird, high up on a telephone wire, suddenly stopped singing and stiffened, and stretching far forward, rapidly fluttered both wings. Dropping directly to the ground below, he displayed—as in courtship—before a juvenile that we believed to be his own. We never again saw an adult display before a juvenile of any age.

Forty-five bunting nests were found by us in 1957. Not all were occupied when found, but all were nests of the year. All were above ground, from 12 to 90 inches up, the average height being 38.7 inches. Nests found late in the season were often at higher elevations than those found earlier. The reason for this was obvious. Much of the concealing undercover dried and thinned as the season advanced. Eleven nests were in Winged Elm *(Ulmus alata)*, seven in Osage Orange *(Maclura pomifera)*, four in Smilax *(Smilax bona-nox)*, four in Post Oak *(Quercus stellata)*, two in Chickasaw Plum *(Prunus angustifolia)*, two in Persimmon *(Diospyros virginiana)*, two in French Mulberry *(Callicarpa americana)*, two in Buckbrush *(Symphoricarpos orbiculatus)*, one in Red Cedar *(Juniperus virginiana)*, one in Smooth Sumac *(Rhus glabra)*, one in Poison Ivy *(Rhus toxicodendron)*, one in Russian Olive *(Elaeagnus angustifolia)*, one in Spindle Wood *(Euonymus japonica)*. Several nests were supported by more than one plant: three in Smilax — Winged Elm, one in Smilax—Osage Orange, one in French Mulberry — Chittam Wood *(Bumelia lanuginosa)*, one in Ragweed *(Ambrosia psilostachya)*—Wild Lettuce *(Lactuca)*. The nests were close to the main axis of the plant, or out on branches, often at the very tip in a cluster of leaves that sometimes dipped low into a concealing understory of grasses and weeds. The nest-trees or -plants were in both dense and thin vegetative cover. One nest was situated in a tiny, isolated Winged Elm (18 inches high) out in an open, grassy field. Several nests were close to a well-travelled gravel road, the closest being only 11 feet from the edge of the gravel.

Many nests of previous years were found. All of these nests were situated like those above, the dominant nest-plants being Smilax, Winged Elm, and Osage Orange. In 1952, a nest was found 20 feet up and far out on the limb of a Winged Elm near the station (Sutton, *ibid.*). We consider such a site in that area rare.

Most of the 45 nests were completed or nearly completed when found and we did not observe nest-building from start to finish at any one nest. One had merely the bottom and part of a side when found June 19 at 10.50 a.m. By 4:15 p.m. the following day, all sides were built up and the lining of the cup started. The lining was finished June 21 and the first egg laid June 22. In one case, the lining was completed after the laying of the first egg. The female alone constructed the nest, gathering material on and above ground, close or far from the nest, on and off territory. Many flying females with nesting material eluded us completely. No males were ever seen with nesting material of any sort. Nest-construction often occurred shortly after sunrise and sunset. Nest-construction by double-brooded females attending young took, apparently, more time and continued, sporadically, throughout the day.

Egg-laying took place shortly after sunrise when the female returned from roosting. The time of laying was determined for 21 eggs (eight nests). All of these eggs were laid between 5:00 a.m. and 6:30 a.m. We did not record egg-laying at a later hour, and there is nothing in our data to indicate that it ever occurred much later in the day. The actual laying of an egg was noted at two rather exposed nests. In each of four occasions, the bird in the nest suddenly raised or elevated her body from a low to a very high setting position, spread her tail, puffed out her feathers, and while elevated, occasionally turned about. This lasted from one to seven minutes. Upon laying the egg, the bird again settled low in the nest, and on two occasions fell fast asleep. One bird, having just laid an egg, stood on the rim of the nest and peered down at the eggs before settling. Freshly laid eggs were sticky and difficult to mark.

When nest flushed, the female made no alarm cry. She simply slipped off the nest, usually obliquely to one's approach. Then she returned a moment later and chirped. We failed to note or identify injury-feigning by either sex.

Predation and cowbird parasitism made it impossible to determine accurately the clutch-size in most bunting nests. The clutch-size at 16 nests was three (nine nests) and four (seven nests). Both clutch-sizes occurred early and late in the season.

The female attended the eggs. During incubation the male only sporadically visited the nest-tree. But that he did so occasionally there is no doubt, for we trapped males within two feet of the nest. Sometimes the trap went unsprung for several days, indicating that males did not regularly go near the nest. Not once did we see one *alight* at a nest; nor did we ever see one sing from the nest-tree. Ten to 75 yards out from there they usually sang from favorite perches. Often they disappeared from the territory altogether but never for very long. They fed both on and off territory. During daylight hours females left the nest sometimes for more than a half hour to feed on or off territory. These females fed most often in mid-morning and late afternoon and during evening before sundown, but there was no precise feeding schedule, even for individuals of both sex, so far as we could tell. During darkness females remained on the nest and were not overly disturbed by flashlight and some were reluctant to flush when

touched. Once flushed they soon returned to the nest even on moonless nights. Where the males roosted throughout incubation and fledging remains a moot question.

The period of incubation, i.e., the time interval from laying to hatching of the last egg of the clutch, was 11 days and six hours at each of three nests under scrutiny. At a fourth nest, it fell somewhere between 11 days, 6 hours and 11 days, 9 hours. The period of hatching, i.e., the time interval between hatching of the first and last eggs, varied significantly. This was expected since incubation started before or after completion of the clutch. The hatching period of one three-egg clutch was at most only 4.5 hours, that of another three-egg clutch was at least 23 hours, and that of one four-egg clutch was at least 40 hours. Commonly, incubation began with the laying of the next to last egg of the clutch, the spread of hatching being about one day.

Chicks pipped their shells on the 10th day. A hole slightly larger than a millimeter in diameter usually appeared in the side of the shell within a few hours of hatching. The shell was not cut even half way around. It merely broke in two and the chick emerged rapidly. The female then carried the half-shells and dropped them on the ground sometimes as close as fifty feet away.

Newly hatched chicks weighed about two grams. They gained about one gram per day on the average until 10 to 11 grams were attained by fledging. Upon hatching they were naked and only scantily covered with light down; their eyes did not open wide until the third day. Development of the remiges proceeded rapidly, but the chicks remained mostly naked into the seventh day. Then the body feathers burst from their sheaths. Although an eight-day-old chick was capable of flying, it was not well feathered until the ninth day. Even then there were conspicuous "naked" areas.

The female attended the nestlings—the young in the nest. As during incubation, the male parent only sporadically visited the nest-tree. Not once did we see a male carry food to nestlings. The female gathered food both on and off territory, using no special entrances or exits at the nest-tree. Flights to and from the nest were rather conspicuous. Fecal sacs were dropped at various distances from the nest. When obviously disturbed by our presence the females lingered and chirped with food in bill not far from the nest. They went to the nest sooner when the male sang near by, for the song was an apparent releaser in this respect. Most females became accustomed to us within a short time, and some even fed nestlings while we sat fully exposed ten feet away. Conditioning of this sort had to be constantly reinforced. Food for the nestlings, so far as we determined, consisted entirely of insects —including caterpillars, grasshoppers, and small beetles.

Females frequently brooded between feedings, especially when the nestlings were small. They also brooded at night. One brooded three young constantly for eight nights and then abandoned them on the ninth—on the eve of fledging. Having roosted far from the nest-tree, she returned in dim light the following morning (5:25 a.m.) from across a wide cultivated field. Then she brooded for 11 minutes before fetching food.

Fledging occurred on the 8th or 9th day. The oldest chicks remained in the nest for nine days; but the youngest chick, often younger by a day, usually fledged about the same time as its older siblings. One eight-day-old chick actually left the nest several hours ahead of a nine-day-old sib, at a time when we were away. When put back in the nest it remained another 24 hours but would not stay put after that. This was the only case where an eight-day-old chick remained in the nest after it had fledged. All other eight- and nine-day-old chicks would not stay put. Since the eight-day-old chick flew fairly well, we considered it fledged when it left the nest.

Painted Buntings about to fledge did not suddenly bolt from the nest. Crowded, they nudged their way toward the female parent whenever she brought food. The drive to approach the parent was very strong even in nestlings, and this drive increased until, by fledging time, they climbed on one another, on the rim of the nest, and often on the supporting limb close by, settling back in the nest once the female left. When they left the nest finally, they gradually moved into the surrounding foliage. Some tumbled straight down to the ground. There they were fed by the female who readily located them by their loud food-chirps.

At first these fledglings, half walking, half fluttering, made their way laboriously through the ground vegetation, and in doing so became dispersed. Within a few hours they worked their way back to the upper foliage where they remained mostly still, calling when hungry, and occasionally flying from branch to branch or bush to bush. One nine-day-old chick that had remained on the ground for three hours after falling from the nest suddenly flew straight up and alighted on a limb six feet above the ground; another made its way up by successive short flights. Although fledglings occasionally flew down to the ground, we never saw one accidentally fall after it had once fallen from the nest. Considering their age, they were incredibly agile and strong of wing. Three fledglings, each nine days old and out of the nest less than two hours, flew 50 feet before alighting in upper foliage. When approached most nine-day-old chicks (Fig. 2) and some ten-day-old chicks remained still on a perch and were easily caught by hand. We failed to catch older chicks.

Certain pairs continued to nest after they had a successful fledging and were—in a true sense of the term—double-brooded. In full charge of the brood, the female alone constructed a new nest near her old one. The male dramatically took over the brood just before egg-laying, and thereafter the female had nothing to do with the brood, so far as known.

One female (57-81508) built her new nest 14.5 feet from the old one. Already large and substantial when discovered four days after her young had left the old nest, construction must have started soon after the fledging, perhaps before. Building continued between feedings of the young, all of which remained close by within the territory of the male. In a single breath she fed a chick, reached out and pulled nesting material from a branch near by, placed the material in her nest several feet away, and then flew off to gather more food. At times construction lagged, sometimes it was hurried along, but there was no regular building period. Now the male courted. Seven days after

the fledging and on the very eve of egg-laying he took charge of the brood. Between feedings he chased the female about the open fields on territory. Twice we saw him follow her into high grass where copulation probably took place. An egg was laid on each of three following days. The brood often visited the nest-tree and sometimes flew close to the incubating parent; but there was no visible sign of recognition or show of excitement between them.

This bunting's nest was wholly different from her old one. The old nest, small and compact, was 22 inches above the ground and attached to vertical stalks of Giant Ragweed and Wild Lettuce. The new one, large and bulky, was saddled 82 inches up on a horizontal limb of a large Persimmon. Bunting 57-81502 built a nest 15 inches above the ground in a smilax tangle; after the young fledged she built another 27 inches up in an Osage Orange, 32.5 feet away. Bunting 57-81507 built her nest 19 inches up in Smilax; after the fledging she built another 41 feet away in Smilax 88 inches above the ground. Bunting 57-81526 had a nest 54 inches up in a fairly large Winged Elm; after the fledging she built another 73 feet away and 44 inches up in a stunted Winged Elm overshadowed by Persimmon. These findings made clear that individuals do not necessarily select a similar nest-site each time, and that they do not necessarily attach and fashion each nest in the same manner.

Female bunting 57-81502 produced one bunting fledgling and one cowbird fledgling on June 24, i.e., the young fledged on that date.

Fig. 2. Nine-day-old Painted Bunting photographed shortly after leaving the nest. A bunting of this age flies strongly. Note bands on legs. From a kodachrome taken July 29, 1957, by David F. Parmelee.

This double-brooded female produced three more bunting fledglings on July 23—only 29 days after the first brood fledged. Bunting 57-81507 produced three bunting fledglings on June 26; on July 25 she produced one bunting fledgling and two cowbird fledglings — again 29 days between fledgings. Bunting 57-81508 produced three bunting fledglings on June 30; on July 29 she produced three more—again 29 days between fledgings. Bunting 57-81526 produced one bunting fledgling (one cowbird died prematurely) on July 18; on August 17-18 she produced three bunting fledglings—approximately 30 days between fledgings. Thus the time interval between fledgings was not only surprisingly short but remarkably constant.

We suspected other pairs of double-broodedness, but we failed to band and thus establish their identity beyond question.

Sprunt and Chamberlain (1949:515) state that in South Carolina the Painted Bunting "raises three broods, sometimes possibly four." Apparently this statement on triple-broodedness was based on dates for succeeding broods (June 11 and July 15), and on a late brood noted September 16.

We never saw a brood being fed by both parents at the same time. They were often seen together with the brood, but only one fed. This also happened when a pair and their chick were caged together. The female immediately took charge and fed the chick until it cared for itself. The male fed it but twice. Not only did he eat unhesitatingly while facing the begging chick, he even snatched food from its mouth. The female, on the other hand, invariably snatched insects from the male and gave them to the chick. So intent was she in her feedings, that she readily took insects from our fingers.

The male under normal circumstances fed young only when the female was involved in another nesting. Although we do not consider the matter final, there is nothing in our data to the contrary. The comings and goings of the bright males attending young were easily followed. Flights to and from the brood were mostly direct, and the favored hunting grounds were the open or semi-open fields on territory. Flying low over the field the male suddenly plunged into the grasses, the tops of which swayed as he made his way through the understory searching for insects. Flying out of the grasses, he often went to some tree limb to kill his prey. Then he flew back to the brood. Feedings were intense or casual. For the most part he kept the brood within his territory. Hard pressed as he often was during this period, he still sang from his perches and chased trespassing males.

Female buntings not involved in another nesting attended young until parent-offspring relations broke down. A female thus employed did not always keep the brood within the territory of the mate. Some even moved into adjacent territories and were tolerated. Movements of the females were more difficult to follow. Their flights to and from the brood were fairly direct, but the favored feeding places were less restricted.

The fledgling, like the nestling, was strongly attracted to the parent (of either sex) arriving with food. When the parent alighted near by, on or above the ground, the fledgling often flew directly to it and begged clamorously. With outstretched neck it fluttered its wings so

violently that it was conspicuous. Often the entire brood approached and begged together. As the young grew older they flew greater distances to the parent. This irresistable drive or compulsion to go to a parent for food must be part of the mechanism that keeps the brood within a given area.

The characteristic posture of the juvenile was one of begging, even when the adult was away. It kept its wings low, relaxed, almost droopy. In this it was strikingly unlike the adult with wings set high, tucked in. This peculiar juvenile posture was still pronounced in a 30-day-old captive chick.

An eight-day-old chick taken from the nest quickly responded to our approach and begged food from us. When placed with its captive parents two days later it begged equally often from both of them, even when they had no food. Parental sex made no difference. It is not surprising then that a brood suddenly accepts the male in cases of double-broodedness.

One bunting fledgling was placed with another brood of buntings that had just fledged about a mile away. The foster parent (female) raised it with her own brood of three.

The food-call of the juvenile was a loud, often persistent, single or double chirp, distinct from alarm notes of adults. We did not understand the significance of the single or double note. It appeared not to be a matter of age but of individual variation. A series of notes not recorded by us in the field was given repeatedly by the captive female attending her chick. These notes—usually *chew-chew-chew-cheee* oft repeated, sometimes *chew-cheee-chew-cheee-chew-cheee* oft repeated—were invariably given when this bird, with food in bill, tried to induce the chick to eat. At such times the chick, already stuffed with food, ignored her. These inducing notes were not clearly audible beyond five or six feet. They may have been similar to ones given by females attending small nestlings, but we never heard those notes clearly, and we did not understand them.

Grasshoppers of various kinds were readily accepted by the captive pair, but they had to be of a certain size, i.e., not too large. The larger ones taken were thoroughly crushed. Wings, legs, often the head, were nipped off and discarded or eaten. The thorax and abdomen were macerated but left in one piece. This was carefully thrust far back in the throat of the chick by the female. When not swallowed immediately, she took it away and then quickly repeated the performance. Food was retrieved when accidentally dropped by adult or chick. One non-captive female retrieved an insect that had dropped nearly 15 feet to the ground. Small insects were invariably killed but usually not picked apart. Spiders, damselflies, and walking sticks were readily taken by the captive birds, but dragonflies, true bugs, butterflies, and moths were not.

Young of two different broods, respectively 26 and 29 days old, captured and ate insects on their own. Young 32 days old ate grass seeds on their own. All of these young were still under parental care. Other field observations indicated that even younger juveniles were capable of feeding without parental help, and for this reason the feedings of the captive juvenile were closely watched. When 20 days

old the juvenile chased and attempted to kill and swallow grasshoppers, but it was not successful in this until the 23rd day. When 26 days old it cracked seeds for the first time—as expeditiously as the adults. Very noticeably it begged less often at 29 days, and the adult fed it but once during the following three days. When 33 days old it refused grasshoppers and fed thereafter exclusively on seeds and other vegetation. Non-captive birds, 38 days old and not under parental care, caught and ate insects, but this was not observed in older juveniles.

The captive juvenile drank water frequently after 27 days old, but we do not know when it took its first drink. Juveniles 32 days old, and older, often visited pools in the gully bottoms. There they splashed, thoroughly wetting the plumage. Then they perched high and preened in direct sunlight.

One brood was observed each day from fledging until the parent-offspring relationship broke down. All three young were nine days old when fledged. At first they remained with the female (double-brooded), but when 16 days old they became the charge of the male. The brood was remarkably compact, i.e., the young stayed together and did not scatter for any great length of time. As they developed they became less sedentary and followed the male about on territory, often one behind the other. They were seen off territory, briefly, when 30 days old, and thereafter were seen off territory more frequently and for longer periods. All three were last seen together when 32 days old. Two remained and still begged and received food from the male when 34 days old; but the relationship was dissolved a day later. The male parent mostly remained near the nest-tree of its mate which was then attending nestlings. By the 39th day only one of the original brood was seen. On the 41st day one was collected—only 83 feet from the nest in which it had hatched. In the meantime the new brood fledged. The female and brood left the territory which, until then, had been defended vigorously by the male. Then he, too, abandoned the area and followed. When last seen, four days after the fledging, all were together, off territory, some 300 yards from the original nest-site.

Just what initiated the breakdown between parent and offspring is not known. The break was not sudden. Young of the year flocked together, and this flocking or mixing of broods (some of which were banded) occurred even while part of the flock was still being fed by an adult. Thus it appeared to be a gradual breakdown, and even after it was final, the young occasionally returned, sometimes with other young, to the original territory.

Polygamy existed among the buntings, but just how widespread it was throughout the population is uncertain. Males on territory appeared to have a single mate. This could have been an erroneous assumption of ours, for once a nest was found further search in the same territory was mostly discontinued. Quite by accident we found two active nests (nos. 15 and 16) only 45.5 feet apart in an area occupied by a single male. The females with their broods were captured and marked, but the male was not captured until it was attending the brood of nest 15—at a time when the female from that nest was involved in another nesting. The female of nest 16 was not double-brooded. She took her brood

across a well-travelled road into an adjacent territory and raised them there. The male of that territory—captured and identified with still another female and nest—courted her for a week but in vain. Occasionally the female and brood briefly visited the original territory. Indeed, they and the brood of nest 15 were seen together in a nest-tree then occupied by the female from old nest 15. We did not discover which male fathered the brood of nest 16. The only times we saw a male with the female near that nest was on the day before and when the brood fledged. No males were marked then. In any event, here was a situation in which there were three employed females in two territories each defended by a male.

The roosting habits of the buntings baffled us. Although some 50 hours were spent searching for them at night in well-known territories, we never did find adult males or fledged young older than 12 days at roost, and only once did we find an adult female at roost aside from nesting. At dusk on July 30, a pair flushed from a small clump of mixed trees. A moment later the female (banded by us previously) returned alone to the identical spot, fluttered from perch to perch, and in a little opening finally alighted on a slender oak branch four feet above the ground. There she preened in near darkness before settling down. She remained on the same perch throughout the night, but her mate and 20-day-old young we did not find. The abandoned nest of these birds was about 125 yards away. We never found any of them roosting in or near the oak again.

Attempts to follow males to roost at dusk failed time and again. They simply escaped us. One flew a hundred yards from its territory in dim light and dropped down in a corn field. Whether it remained there throughout the night is questionable. For all we knew the buntings may have regularly roosted off territory.

In 1957 flood waters of Lake Texoma inundated much land about the station and temporarily destroyed habitats otherwise occupied by buntings and other animals. Many animals then concentrated in number on high land adjacent to the flooded areas. This probably was why the buntings among others appeared more abundant than usual near the station. Very conspicuous at that time were a variety of bird-eating snakes—the chief predators of bunting nests that year. Before the flood waters subsided very much these predators, especially the Coachwhip *(Masticophis flagellum)*, were seen surprisingly often, every day. Alarm cries and frantic flutterings of adult buntings of both sex invariably led us to one of them. At one bunting nest, a Common Kingsnake *(Lampropeltis getulus)* had already grasped a fledgling before we intervened. At another, we finally shot a Racer *(Coluber constrictor)* that repeatedly tried to reach the nestlings that were about to fledge. The nestlings were then placed in a cage where the parent could feed them, but a Rat Snake *(Elaphe obsoleta)* entered through a narrow crack and ate them.

When the waters receded many animals reclaimed the lake shore habitat. Although mostly dead trees and practically no undercover except withered smilax tangles remained, some buntings nested there, indicating establishment of late territories. One nest was on a branch below the high water mark of a Winged Elm. Fewer and fewer snakes

were seen as the season advanced. Predation of birds in general fell off after mid-July.

Avian and mammalian predators of birds were scarce, and we found little evidence of their destroying buntings or their nests. Two nests contained bunting eggs that were crushed. Tiny ants (classification uncertain) destroyed one, possibly two, nests that we knew of. One we had watched critically since egg-laying. The ants moved up and down the nest-tree and crawled over the nest during incubation; but they did not cause the bunting to desert. During hatching the ants killed the first chick and also the second which had merely pipped its shell. This resulted in nest desertion. Another nest overrun with ants apparently was deserted before egg-laying. Ants also killed a young cowbird that left a bunting's nest prematurely; but its nest-mate, a bunting, survived by staying in the nest until able to fly.

Many cowbirds were shot near the station before and during the investigation. In spite of this, at least 13 of the bunting nests found were parasitised by them. All but four of these were deserted during egg-laying. We do not know why the buntings deserted one time and not the next, but our observations support a point of view that nest desertion by the species occurs when the nest is parasitised early in egg-laying, before the third or fourth host egg has been laid. If parasitised later, the bunting does not desert, even if the cowbird then destroys some of the host eggs. No more than two cowbird eggs or young were found in a bunting nest. No cowbird eggs were found buried in bunting nests. One cowbird egg was found broken on the ground directly beneath a nest that had three buntings only. Latest date of a fresh cowbird egg in a bunting nest: July 3; latest date of a cowbird young in a bunting nest: July 25. In a nest containing one bunting and one cowbird, the bunting fledged first. In one with two buntings and a cowbird, a bunting and the cowbird fledged (together) first. The female bunting fed cowbird juveniles out of the nest, but we were uncertain if the males ever did.

An important factor in breeding success of the species is nest durability. Small young at two nests fell to the ground when the nests tipped low on one side. Another nest fell all the way to the ground. To keep these young alive we stitched the nests firmly to their supports by needle and thread. One nest simply disintegrated in a light rain, spilling three small young nearly seven feet to the ground. Rain occurred but once during our stay; but persistent inclement weather during nesting would certainly ruin many active bunting nests in southern Oklahoma.

Several nests found were not well shaded from the sun. All embryos in four eggs at one nest apparently died from overheating. One bunting lined her nest with horse hair and frequently became entangled in it. When two of the three eggs were thrown out of the nest by such entanglements, we removed the lining. The third egg survived.

Loss of eggs resulting from predation and cowbird parasitism made it impossible to determine the total number of eggs laid in all 45 nests, and it is not feasible to state breeding success as percentages of young fledged to the total number of eggs laid, or young fledged to the number of eggs laid in the nests which did produce young. This much we

know: One of the 45 nests contained feather sheaths only, indicating successful fledging of an unknown number of young. Of the other 44 nests, only 19 produced young—48 in all. At least 53 eggs had been laid in the 19 nests, but this figure is too low. Thirty-seven young (from 15 of 19 nests with young) fledged. The remarkable fact is that 19 of the 37 fledglings were produced by only four double-brooded females. Three of the double-brooded females were parasitised by cowbirds which reduced the bunting clutch-size. The double-brooded female unmolested by cowbirds produced at least six fledglings (from seven eggs) in 1957.

Generally, it may be said that the nest of the Painted Bunting is highly vulnerable to destruction. Yet, it is obvious that the species is very successful in southern Oklahoma where it is so abundant. The species endures and overcomes high mortality of nests by virtue of its high breeding potential. There is little doubt in our minds that a few females favorably situated can produce enough young to maintain the population when the majority fails. Bumper crops can be expected when breeding conditions approach the ideal. Conceivably, some buntings may be triple-brooded, but we have no evidence that this is ever the case.

Why some females were "favorably situated" or just what constitutes a favorable situation is uncertain. The double-brooded females did not choose a particular kind of site each time; nor did their choice of sites differ, seemingly, from those of less successful females. A variety of nest types and nest locations produced young. However, nests placed in an upright crotch endured wear and the elements best; those saddled on a limb or situated in vines or in a loose cluster of leaves at the end of a branch were less durable. Well-shaded eggs or young had obvious advantages. Cowbirds parasitised a variety of nest types and locations. With respect to predation, the site of the territory seemed important. Certain predators were noted time and again in some territories, much less often in others.

Why some females were double-brooded and others not, is also uncertain. Age may be a factor, but there is no evidence of this for the species. The polygamous male bunting and his ability to care for a given number of young at one time may well be an important factor why some females do not proceed with another nesting, even when there is sufficient time. We do not know if female buntings ever mate with more than one male during one season. Seemingly, the whole question of polygamy has to be better understood before we fully understand double-broodedness in this species.

Not all buntings had stopped nesting by the time we departed. There were at least two active nests, one with eggs and one with 5-day-old young. Observations at these nests were continued by W. M. Pulich who later wrote that the eggs at the one nest hatched during August 9-10, and that the young of that nest fledged sometime during August 17-18. We know of no later bunting nesting for Oklahoma.

Adult buntings did not undergo extensive postnuptial molt up to the time of our departure. It seems unlikely that they ever do before migrating from Oklahoma. Males continued to sing into August, but frequency of song fell off after mid-July. We recorded the last full

song August 6. Apparently there are no late August or September records of adult males for the state, the latest one being our own (August 9, Marshall County). Latest recorded date for an adult female: August 18, Marshall County (Pulich, *in litt.*).

Flocks of juveniles were common by early August, and apparently they remain fairly common locally in the state into September (at least one specimen available). October dates for "female-like" Painted Buntings have been noted for Woods County in northern Oklahoma (Sutton, *ibid.*).

A number of banded juveniles of known age were collected by us in 1957. These include 9-, 15-, 19-, 21-, 25-, 31-, 35-, and 41-day-old birds. All of them were collected near their nests—good evidence that juveniles of these ages are not rangy. These specimens, including adults, will be reported on in a separate paper dealing principally with plumages and molts of the species.

The Indigo Bunting *(Passerina cyanea)* was both scarce and local, and we found no situation where it and *ciris* bred side by side, although conceivably they do just that in parts of Marshall County. When compared with this work previous studies on the Indigo Bunting (Forbush, 1929:118-121; Allen, 1933:227-235; Bradley, 1948:103-113) indicate that there are significant differences in the breeding behavior of the two species. Ideas differ on the role of male *cyanea* at the nest and in care of young. According to Bradley only the female incubates and "All parental care while the young Indigo Buntings are in the nest is given by the female"; but according to Forbush both sexes incubate and attend nestlings. Allen states that although the male Indigo Bunting does not brood, both sexes attend nestlings and further substantiates this belief with a photograph of a male feeding young at a nest. According to Allen both parents attend fledged young until the young feed themselves. He further states that *cyanea* is double-brooded, but that the interval between the start of the first nest (e.g., early June) and that of the second nest (e.g., late July or early August) is long. This certainly is not the case with *ciris*. The 12-day incubation period of *cyanea* by Forbush and Allen is nearly a day longer than that of *ciris*. Bradley states that eight- and nine-day-old *cyanea* fledge as very weak flyers and that they then remain on or close to the ground. According to Forbush and Allen, young *cyanea* remain in the nest 10 to 13 days. Eight-day-old *ciris* fledglings fly and the nine-day-old ones are strong of wing and mostly remain fairly high above the ground soon after fledging.

SUMMARY

1. The breeding behavior of the Painted Bunting *(Passerina ciris)* was studied near the north shore of Lake Texoma in Marshall County, Oklahoma, from June 15 to August 9, 1957. Particular attention was given the fully adult birds with respect to the role played by each sex at the nest and in care of young.
2. Previous records indicate that the species arrives at Marshall County as early as mid-April, but not in force until late April or early May. The arrival of adult females is poorly known.
3. Egg-laying in Marshall County probably commences as early as mid-May. In 1957, nesting was well under way by mid-June, but early phases of the breeding cycle were repeated even into July.

4. The species was among the commonest of the passerine birds. It was most numerous in the thinly wooded places, in primarily agricultural areas where some land was feral.
5. Throughout nesting, the nest territories were vigorously defended by males against other males of the species. Trespassing females with or without broods were tolerated by both sexes on territory. Defensive displays resembling courtship displays occurred among males.
6. Ground displays and flight displays by courting males occurred during pair formation, during the period preceding egg-laying, and during egg-laying. One adult male displayed as in courtship before a juvenile.
7. All 45 nests found in 1957 were placed 12 to 90 inches (average 38.7 inches) above the ground in a variety of plants. The nest-trees or -plants were in both dense and thin vegetative cover.
8. The female alone constructed the nest. Nest-construction required as little as two days. Lining the nest was completed before or after laying of the first egg.
9. Egg-laying occurred shortly after sunrise when the female returned from roosting.
10. The clutch-size at 16 nests was three and four. Both clutch-sizes occurred early and late in the season.
11. The female alone incubated and left the nest to feed. The male only sporadically visited the nest-tree and rarely approached the nest. Males sang near but not in the nest-tree. Each male had several singing perches on territory.
12. Incubation started before or after completion of the clutch. Commonly, it began with the laying of the next to the last egg. The period of incubation in three known cases was exactly 11 days, six hours. The period of hatching varied from 4.5 hours to at least 40 hours.
13. The female alone attended the nestlings. She brooded between feedings and at night.
14. Fledging occurred on the 8th or 9th day. Eight-day-old young flew fairly strongly, nine-day-old young very strongly.
15. Some Painted Buntings were double-brooded. In full charge of the brood the female alone constructed a new nest near her old one. The new nest was not necessarily situated or fashioned like the old one. In one known case, egg-laying took place eight days after the young fledged.
16. The time interval between fledgings in four cases of double-broodedness was 29-30 days.
17. With respect to double-broodedness, the male took over the brood just before egg-laying. He then cared for the brood until parent-offspring relations dissolved. When not double-brooded, the female cared for the brood until parent-offspring relations dissolved.
18. The brood remained together and did not range far from the original nest-site.
19. A captive 23-day-old juvenile caught and ate insects. When 26 days old it cracked and ate seeds. It refused to take food from the parent when 33 days old. Non-captive juveniles, 26 days old, caught insects while still attended by the parent. Adults fed young until parent-offspring relations dissolved.
20. Juveniles of different broods flocked even while some individuals of the flock were still attended by adults.
21. Parent-offspring relations dissolved gradually. It ceased altogether when the young were 33-35 days old. Unattended juveniles often returned to the original territory.
22. Polygamy existed among the buntings.
23. Flood waters forced the Painted Bunting among other animals to concentrate in certain areas. When the waters receded the buntings among others reclaimed the shore habitat.
24. Bird-eating snakes were principal predators of the species during nesting. The species was commonly parasitised by cowbirds.
25. The nest of the species was highly vulnerable to predation. Nest durability was important in nest success.
26. Nineteen of 44 nests produced 48 young. Nineteen of the 37 young that

fledged were produced by four double-brooded females. One double-brooded female produced at least six fledglings in 1957.

27. The species endures and overcomes high mortality of nests by virtue of its high breeding potential.
28. Adult males sang full songs as late as August 6. Adults did not undergo postnuptial molt during nesting.
29. Fledging occurred as late as August 17-18.
30. Adults apparently migrate south from Oklahoma before molting. There are no September or later records of adults for the state. Juveniles have been recorded in September, female-like birds in October.
31. Differences exist in the breeding behavior of the Indigo and Painted Buntings.

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THE BAL-CHATRI: A TRAP FOR THE BIRDS OF PREY

By DANIEL D. BERGER AND HELMUT C. MUELLER

In spite of the abundance and variety of traps left to us by many generations of falconers, the raptors remain among the most difficult birds to trap. The device presented below is the best all-purpose trap we have encountered in nearly a decade of experimenting with the various techniques for capturing hawks. It has the advantages of being small, having no moving parts, and can be thrown into the vicinity of a hawk from a moving vehicle. As with most trapping techniques, the device is an adaptation of an ancient idea. For many years the east Indian falconers have taken hawks in horsehair nooses affixed to the exterior

of a cane cage which contained several live lure birds. MacPherson (1897) designates this trap as a "Shikra Trap." Craighead (1942) gives *bal-chatri* ("boy's umbrella") as the Indian name of this trap. The latter has become the accepted name. In our bal-chatri we have substituted hardware cloth and monofilament nylon for cane and horsehair and changed the dimensions to enhance portability, but the basic idea remains unchanged.

TRAP DESCRIPTIONS

The bal-chatri is a hardware cloth cage covered with slip-nooses of monofilament nylon. Three types satisfy our present requirements although it is possible that none of these may be suitable for some of the many species of raptors with which we have not yet had experience. It is interesting that we have yet to catch a single one of the short-winged species for which the Indian bal-chatri was used.

Type I. The first of our two basic traps is in the shape of a cylinder six inches in diameter and two and one-half inches high constructed of one-third inch mesh hardware cloth. A door in the bottom permits the deposit and removal of bait. The top is uniformly covered with 40 one-inch-in-diameter nooses of four lb. test nylon. A metal strip is wired circumferentially to the bottom to bring the gross weight of the trap to eight ounces.

Type II. This trap differs from type I in having about 35 nooses of 15 lb. test nylon, each one and one-half inch in diameter. A somewhat heavier strip is attached to the bottom in the same manner as in type I so that the total weight of the bal-chatri is brought to twenty ounces.

Type III. This trap is hemicylindrical, or quonset shaped, twelve inches long, ten inches wide, and six high. The ends and top of this one-half inch mesh hardware cloth cage are covered with some one hundred nooses of twenty lb. test nylon. Each noose is one and one-half inch in diameter. Again, this trap should be weighted at the bottom sufficiently to cause it to land right-side-up, but the total weight should not exceed twenty-four ounces if possible. The door, as in all of our traps, is in the bottom. This bal-chatri was designed specifically for the trapping of Harris' Hawks *(Parabuteo unicinctus)* and is not necessarily particularly well suited for the capture of any other hawks except possibly other gregarious species.

Weighting our traps at the bottom with strips of lead or iron causes them to right themselves, even when rolling, after being dropped from a moving automobile. The weights are light enough so the hawk may drag the trap a short distance, but heavy enough to keep the bird from carrying it away. If the trap is too heavily weighted, the abrupt pull of the striking hawk may snap the nooses.

The efficiency of a bal-chatri is dependent on several things. First of all in order to attract the hawk an active lure is essential. Then after the hawk strikes the trap it is important to have properly tied nooses of optimum diameter and density. We have come to expect a catch of at least 95% of the Kestrels that actually strike the trap.

Nooses may be tied in several different ways. Our method is diagrammed in Figure 1. After each noose is attached to the trap as

FIG 1

shown in Figure 1 the attachment knot can be tightened by inserting a pencil through the noose and pulling away from the trap. Now the noose, which so far has been closed, should be spread open and adjusted so that it stands as nearly erect as possible. A drop of Duco cement at the point of attachment will secure the knot and keep the noose erect. A No. 13 crochet hook considerably increases the speed of the operation. This tool is also useful in reopening nooses after a hawk has been captured. We have experimented with several brands of monofilament nylon and have found the J. C. Higgins brand, sold by Sears, Roebuck and Co., to be very satisfactory and inexpensive. Limp nylon is the most desirable. A bal-chatri requires very little maintenance. One must simply see to it that nothing is left lying on

top of the nooses while the trap is not in use. Occasionally regluing or replacement of the nooses is necessary.

LURES

We have used, with varying success, several species of birds and mice for bait. House Mice *(Mus musculus)* are by far the most satisfactory of the rodents. Other species are erratic in their activity within the trap and often fail to attract the hawks' attention. However, Meadow Voles *(Microtus* sp.) can also be used with some success. Fitch (1950), Howard (1953), and Howell (1954) give descriptions of live traps for mice. Several commercial models are also available. Freshly-caught English Sparrows *(Passer domesticus)* can also be used but they soon learn to "freeze" upon sighting a hawk and will remain inactive, and thus unattractive for extended periods. Due to this disadvantage and also to the fact that sparrows are relatively difficult to keep, especially while travelling, we much prefer to use mice for trapping most species. Though we have had our greatest success with the House Mouse, we have also used, in order of desirability, Meadow Voles *(Microtus pennsylvanicus)*, Deer Mice *(Peromyscus* sp.), and Pigmy Mice *(Baiomys taylori)*. Of these only House Mice have proven to be consistently active enough for good lures. Their activity is not arrested by a hawk passing at them and they are easy to keep in captivity. The action of individual House Mice actually seems to improve with use contrary to all our experience with other species of mice and certainly with sparrows. For the large trap (Type III) we have found Starlings *(Sturnus vulgaris)* to be the most consistent performers. Two Starlings will produce an almost constant activity which is increased, instead of halted, when a hawk approaches. If birds are left in a bal-chatri for more than a few minutes they will often pull

Fig. 2. Bal-chatri with mouse.

nooses through the hardware cloth and hang themselves. This is easily prevented by tying the mandibles together.

We have had good success in keeping most species of mice in one-pound metal tobacco cans with perforated covers. The can should be kept about two-thirds full of dry, shredded newspaper, and the mice supplied with grain or commercial mouse pellets and a little vegetable matter for moisture every two or three days.

We have kept Starlings successfully only after providing dark roosting boxes in the cage. We have found them to thrive when provided with dried dog food, and a copious supply of fresh water.

THE TRAPPING PROCEDURE

Although the bal-chatri can simply be left in a likely location and visited at intervals, it is most efficiently used when dropped from a moving vehicle as close as possible to a sitting hawk. We always carry traps and mice in our automobiles, and trap hawks as we encounter them. Hawks, especially Kestrels, are frequently found perched on utility poles or wires. Upon sighting a bird we generally pull off onto the shoulder of the road, slow down to ten miles per hour, and drop the trap as we go by. If at all possible we try to drop it off from the side of the car that is away from the bird. It is best to open the door wide enough to accommodate the dropping procedure somewhat in advance of the actual dropping and to hold that position until safely past the bird. Any swinging of the door or undue movement inside the car while close to the sitting hawk is apt to flush it—especially while driving slowly. In some circumstances, hawks will flush if the above technique is used and it is best then to approach the bird as closely as possible, drop the trap, and back up. In either case we generally

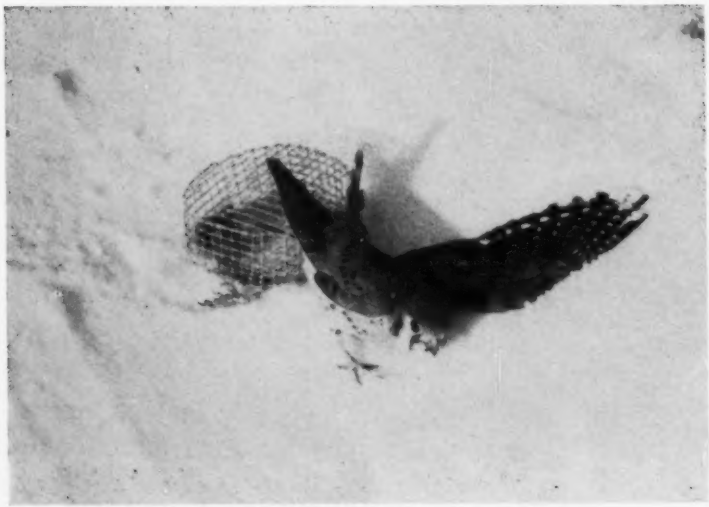

Fig. 3. American Kestrel caught on Type I bal-chatri.

park between two and three hundred feet from the bal-chatri while waiting for the hawk to come in. Often this is a matter of only several minutes and sometimes only a few seconds. Most of the Kestrels that come in to the trap land on the top and are quickly ensnared during their frenzied attempts to clutch the lure. It is not always evident just when the bird becomes entangled; however, if the road is well travelled the first passing car is likely to answer this question since the bird will probably panic. The work of resetting nooses can be considerably reduced by retrieving the hawk as soon as possible. We have found that while trapping in good country it is best, while driving from one bird to the next, to cover the bal-chatri with a cardboard box or metal container, taking care that the nooses do not become depressed. In this way the mouse can be kept in the trap in total darkness and yet is ready at a moment's notice. The result seems to be a more lively mouse when the trap is in use. When trapping is slow, we keep the bait animals in their cans or cages, and do not put them in the trap until a likely hawk has been sighted.

TRAPPING SUCCESS

American Kestrels

More than 90 percent of the birds of prey that we have caught using the bal-chatri have been American Kestrels. We have already caught 376 of these birds and as many as 22 in one day. During two banding trips to Texas and Mexico—the first lasting 13 days in January 1955, and the second 37 days in December 1955, and January 1956—we banded 227 Kestrels. Our efficiency during the first trip was 45.8 percent, and on the second was 57.8 percent. These figures were obtained by dividing the number of Kestrels trapped by the number of birds for which a trap was dropped, providing that the lure in the trap was seen by the hawk. In other words, we did not include cases in which the bird did not see the lure dropped for it. We feel that we can judge with considerable accuracy whether or not a hawk has spotted the lure.

A composite analysis of these two trips shows that we counted a total of 1,358 Kestrels of which we were able to catch 16.7 percent. Actually, however, trapping was attempted on less than a third of the total number observed which brings our percentage to 52.8. In summary, the fact that we were able to catch one of every two attempted Kestrels in a series of this size (430) is ample proof of the remarkable efficiency of this trap.

Our most outstanding success with the bal-chatri occurred while trapping Kestrels through the semi-arid country from Mission to Laredo, Texas, on January 7, 1955, where we attained a catch of 88 percent by trapping 22 of the 25 birds for which traps were dropped. Our relative trapping success in different parts of the country and at various times of the year seemed to fluctuate mainly with the availability of insect prey. Our lowest "no response" percentage occurred during the winter season in Wisconsin where insect prey was nonexistent. Up to the present time we have trapped Kestrels in Wisconsin, Texas,

Colorado, Wyoming, Illinois, Tennessee, Mississippi, Louisiana, and the Republic of Mexico. Nowhere have we experienced a catch of less than 50 percent.

In Wisconsin we have trapped and banded Kestrels during every month of the year. Although records of our Wisconsin trapping have not been consistently kept, we feel that our trapping percentage is not only relatively high, but surprisingly stable throughout the year. For example, during a one-month period beginning July 29, 1956, we caught 81 percent of 21 birds while 14.3 percent did not respond. Our winter trapping success varied only slightly from that of the summer. During the period December 1, 1956, to March 1, 1957, we caught 80 percent of 30 birds while only 6.7 percent did not respond.

In the summer of 1956 we made our first attempts at trapping family groups of Kestrels. Four groups were tried in or near Milwaukee, Wisconsin. Both adults were seen in 3 of the groups and neither adult in the fourth. All 6 adults were trapped. A total of 12 young birds was observed although probably more existed. Ten of these were trapped, but only one of the 2 that were not caught was classed as unresponsive. On September 4, 1956, along a 1 mile stretch of road in the Owl Canyon about 28 miles northwest of Fort Collins, Colorado, we encountered a group of 15 Kestrels. During the ensuing 70 minutes which were terminated by darkness we trapped 12 of these birds. We felt that with more time we could possibly have taken all of them. Ten of the trapped birds were juveniles.

Harris' Hawks

During our January 1955, banding trip to Texas and Mexico we were very much encouraged by our unexpected success in trapping Harris' Hawks. Being a gregarious species these birds are frequently found in groups of three to six individuals. So we designed a bal-chatri capable of ensnaring more than one bird at a time. Although we had an appallingly inferior trap at that time we had as many as six Harris' Hawks surrounding the trap at one time.

During our 1955-1956 trip to Texas and Mexico we found only one area containing a rather dense population of this species. This was in Kenedy County, Texas, along U. S. route 77 which bisects the King Ranch. On December 29 we drove through this area rather late in the afternoon. At this time few of the 44 birds observed reacted to our lures and none was caught. On January 22, when we returned through the area, we encountered 38 birds. Of these we tried for 18, caught 8, and 2 more escaped after being temporarily caught. We made only 2 multiple catches. In one instance, in Mexico, both of a group of 2 birds were trapped at one time, and in the other, all of a group of 3 were taken. We encountered an extremely fast-reacting bird in the state of Nuevo Leon, in Mexico. We dropped the trap on a well-travelled highway only 20 feet from the bird which was perched low in a rather small tree. Our car was only 15 feet past the trap, which had hardly stopped sliding along the pavement, when the hawk was upon it.

Red-tailed Hawks (Buteo jamaicensis)

Red-tailed Hawks are generally quite difficult to trap with a bal-chatri. We caught our first one only recently on the Type II. Several more were caught on a Type III baited with a Starling. It seems likely, however, that the Type II baited with a mouse will ultimately be the more successful for trapping this species.

Red-shouldered Hawks (Buteo lineatus)

We have had even less success with Red-shouldered Hawks, but then we have made relatively few attempts to catch them. We caught one on a Type III baited with a Starling. Mr. David Seal (personal correspondence) caught a pair of these birds near Rockford, Illinois, on a mouse-baited Type II bal-chatri.

Broad-winged Hawks (Buteo platypterus)

In the spring of 1956 we tried the bal-chatri on transient Broad-winged Hawks. We were amazed by the high degree of success. We failed to catch only one of the six birds which we tried to trap.

Other Birds of Prey

We experimented with the Type III or Harris' Hawk trap on several other species mostly without success. In Texas we used it successfully on a Gray Hawk *(Buteo nitidus)* which was the only one we tried for. Of several Rough-legged Hawks *(Buteo lagopus)* that we tried to catch, one hovered ten feet above the trap for a short time, but this was the most encouraging response we obtained. A Great Horned Owl *(Bubo virginianus)* at dusk swooped low over the trap, but did not strike. We caught several Barred Owls *(Strix varia)* by leaving one of these traps in their hunting territories. For all of these a Starling was used as bait.

We have learned that others using traps similar to ours have had success with several other species viz., Sharp-shinned Hawk *(Accipiter striatus)*, Marsh Hawk *(Circus cyaneus)*, American Merlin *(Falco columbarius)*, Peregrine Falcon *(Falco peregrinus)*, Goshawk *(Accipiter gentilis)*, and Screech Owl *(Otus asio)*. Mrs. Frances Hamerstrom (personal correspondence) caught two Marsh Hawks on the Type III baited with a Starling. She also caught a Goshawk on the same trap baited only with the wings and a few feathers from one of the hawk's previous kills. Dr. Heinz Meng (personal correspondence) developed an ingenious trap of nylon netting over a wire framework instead of hardware cloth. Meng used 2 traps placed about 4 feet apart. The first, which was about 10 inches high and 18 inches square, and was baited with about 20 sparrows, seemed to serve remarkably well for attracting the hawks which would then swerve over and bind to the other smaller trap which contained only 2 sparrows. This smaller trap had sloping sides and was not over 4 inches in height. During several trapping trips on the East Coast during the fall of 1956 Meng trapped 8 Merlins, 2 Kestrels, 1 Sharp-shin, and 1 Peregrine. All of these birds were trapped during migration.

In addition to the birds of prey we have had some interesting experiences with several other species of birds. We have taken numerous

Shrikes*(Lanius ludovicianus and L. excubitor)*, usually using a mouse lure. On one occasion in Texas shortly after a Kestrel had landed on our bal-chatri, a Roadrunner *(Geococcyx californianus)* darted out from the heavy roadside brush and attacked the caged House Mouse, but tore the nooses after being momentarily caught.

CONCLUSION

The bal-chatri is a comparatively simple yet extremely effective device for trapping several species of raptors and can probably be used with some success on most species. It is completely portable and requires little skill to use. There has been no mortality among more than 400 birds trapped. Due to the difficulty of recognizing negative results it is hard to ascertain just how successful we have been at retrapping. We have, however, retrapped six Kestrels—five of them once and one twice. We consider the bal-chatri method of hawk trapping to be a most useful accessory to the bander.

SUMMARY

During the past two and one-half years we have trapped and banded more than 400 hawks and owls of 7 species, mostly American Kestrels, with a modified form of an old Indian trap called the bal-chatri. Others have had success with at least 6 more species. Several different types are used for the various species of raptors. House Mice have been found to be the best all-around lure. The trapping technique usually involves dropping the bal-chatri from a moving automobile in view of a perching hawk. Those that strike almost invariably become entangled within seconds in snares which cover the top of the trap.

ACKNOWLEDGMENT

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WINTER STUDIES ON THE TREE SPARROW, *SPIZELLA ARBOREA*[1]*

By THEODORE DAVID SARGENT[2]

INTRODUCTION

Two general factors operate to produce and maintain an aggregation of birds. These are: (1) the attraction of individuals to a locality, such as a source of food or protection, and (2) the social attraction of individuals to each other. This investigation is an attempt to shed some light on the relative importance of these two factors in the maintenance of winter flocks of Tree Sparrows. By means of a color-banding project during the winter 1957-58, answers to the following questions were sought: How stable, in time and space, are winter flocks of Tree Sparrows? How much wandering do these birds exhibit? What pattern of dispersal occurs upon withdrawal of a food supply of these birds? To what extent can "homing instinct" be demonstrated in the Tree Sparrow?

Relatively permanent winter flocks with restricted ranges have been reported in the Slate-colored Junco (Whittle and Fletcher, 1924), crowned sparrows (Price, 1931), and Black-capped Chickadee (Butts, 1930-31; Wallace, 1941). For the Oregon Junco the suggestion has been put forward that individual birds become integrated into a stable flock by frequenting a common feeding circuit (Sabine, 1955).

On the other hand, Wallace (1942) characterized wintering groups of Tree Sparrows as loose associations. Likewise, Heydweiller (1935) concluded that wintering Tree Sparrows exhibit too much wandering to permit uniform flock structure. In a continuation of her study (Baumgartner, 1938) she concluded that most individual Tree Sparrows have a winter range of from 500-1,700 feet. She correlated longer wanderings (up to her observed maximum of 6,800 feet) with three factors: fall settling, spring excitement, and mid-winter storms. However, a social organization, described as a straight-line pecking order modified by reverse pecks, has been observed in Tree Sparrow winter flocks (Sabine, 1949).

In reviewing some of the work on wintering groups of various species, some difficulty in adequately defining the term "flock" becomes apparent. For the purposes of the present study, "flock" will refer to an aggregation of individuals of the same species forming a separate unit within the population at any given time. It seems preferable to me to apply adjectives to this general term, rather than to change the use of the term to fit different observations on various species or to introduce many new terms.

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MATERIALS AND METHODS

Three banding stations were established around the center of Amherst (Fig. 1, A, B, C). Three Mason traps, baited with a 2:1 mixture of chick-scratch and Hungarian millet, were in operation at each station. Each of the trapping areas was within 25 feet of a window for observa-

Fig. 1. A map of the area of study. A = station A; B = station B; C = station C; N = mist-netting site; E = Arcadia Wildlife Sanctuary; O = systematic observer; ● = "chance" observer.

(Taken from U.S.G.S. maps)

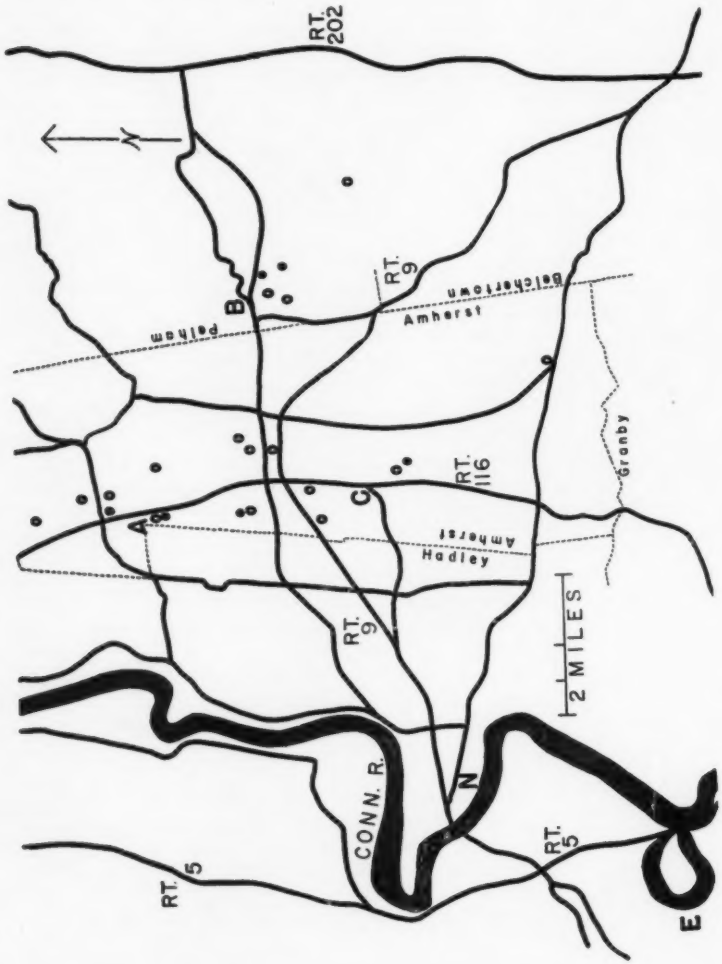

Table 1

Summary of Bandings

Location	Band Color	Type of Color Band	Leg of Color Band	Number Banded
Station A	red	aluminum	left	72
Station B	blue	aluminum	left	72
Station C	green	aluminum	left	102
Hadley	white	aluminum	left	10
Arcadia	pink	plastic	right	6
	yellow	aluminum	left	20

tion and occupied about 100 square feet of ground. A few birds were mist-netted in Hadley (Fig. 1, N) and two groups were banded at Arcadia Wildlife Sanctuary in Easthampton (Fig. 1, E). These latter two groups were transported to station C in "homing" experiments.

Table 1 summarizes the information on the birds color-banded at each location.

In addition to observers at each of the stations, 16 people having feeding stations in the area (Fig. 1, O) were enlisted to make observations of their Tree Sparrows on data sheets which had been supplied. Some of these observers were extremely systematic in taking notes on the numbers, band colors, and behavior of their Tree Sparrows; others could be much less so. Wherever this variance seems important in interpreting the results, it will be discussed. Occasionally I received reports of color-banded Tree Sparrows from people other than the systematic observers (Fig. 1, ●). In judging the accuracy of all observations I could use only such criteria as the observer's previous experience, answers to questions, and occasionally my own subsequent observation. By using a single one-color band per bird, questions of confusing color combinations were avoided.

In taking data, three facts were obtained for each bird trapped: (1) the time of day to the nearest hour, (2) the specific trap in which the bird was caught, and (3) what other individuals, if any, were caught in the same trap at the same time.

Tree Sparrows did not appear regularly at the stations until January 8. Extensive trapping was carried on from that date until February 8. After this latter date, the pressure of other studies allowed less time to be spent at the stations.

RESULTS AND DISCUSSION

Trapping Data

At station C, 102 individuals were trapped; they were retrapped a total of 233 times. At station A, 72 individuals repeated a total of 89 times. However, at station B, only 19 individuals were trapped and none of these repeated. Therefore, under each of the headings below, the data from station C will be considered in detail, comparable data from station A will be presented, and the data from station B will not be considered.

As Borror (1948) has pointed out, any analysis of numbers from trapping data is based on the assumption that all of the birds attracted to the area of the traps have equal chances of being caught. Although trap-shyness or the trap-habit in certain individuals might tend to

invalidate this assumption, probably in terms of the total number of birds in an area it is not too unsound. However, it should be kept in mind throughout the following discussion.

Another point must also be kept in mind. Some of the statistical checks used in the interpretation of the trapping data in the present study are based on the data from fewer individuals than would be desired.

Instability of the Tree Sparrow Flocks about the Stations. Figure 2 shows the banding and repeat data for one month of midwinter trapping at station. It is apparent that the number of new birds trapped was high for the first several days of the month, dropped off for about two weeks, and then markedly increased during the last week. If the month is divided into four periods of approximately equal banding time, this increase of new birds in the last week, as well as the extent to which birds repeated throughout the month, is clearly shown (Table 2).

To estimate the total number of Tree Sparrows in the area around station C at the end of each period (Table 2), the following ratio was used:

$$\frac{\text{Number of individuals banded in previous periods}}{\text{Total number of individuals in the area}} = \frac{\text{Number of banded individuals trapped in a period}}{\text{Total number of individuals trapped in a period}}$$

This ratio is a modification of the "Lincoln Index" (Lincoln, 1930).

The estimates based on this index should have tended to remain constant, if a uniform group of birds was attracted to the area of the traps throughout the periods. However, as is obvious in Table 2, the estimates did not remain constant. The estimate for the last period is far higher than the ratios of new birds to repeats in the two preceding periods would warrant, on the basis of chance sampling (chi-square values of 55.13 and 14.12 respectively). Therefore, it seems likely that changeable groups of birds were being attracted to the area of the traps throughout the month.

Table 2

New Birds and Repeats During Four Periods of Banding at Station C

	Periods			
	I Jan. 8-12	II Jan. 15-21	III Jan. 23-28	IV Feb. 1-8
Number of New Individuals	27	18	9	43
Repeating Individuals from Period I	—	18	6	6
Repeating Individuals from Period II	—	—	5	5
Repeating Individuals from Period III	—	—	—	2
Estimated Number of Individuals in the Area*	—	54	82	233

*See text for method of estimation.

Fig. 2. A chart of the banding and repeat data for one month of trapping at station C. Dates of banding across the top, hours of banding per day across the bottom, and individual band numbers down the left column.

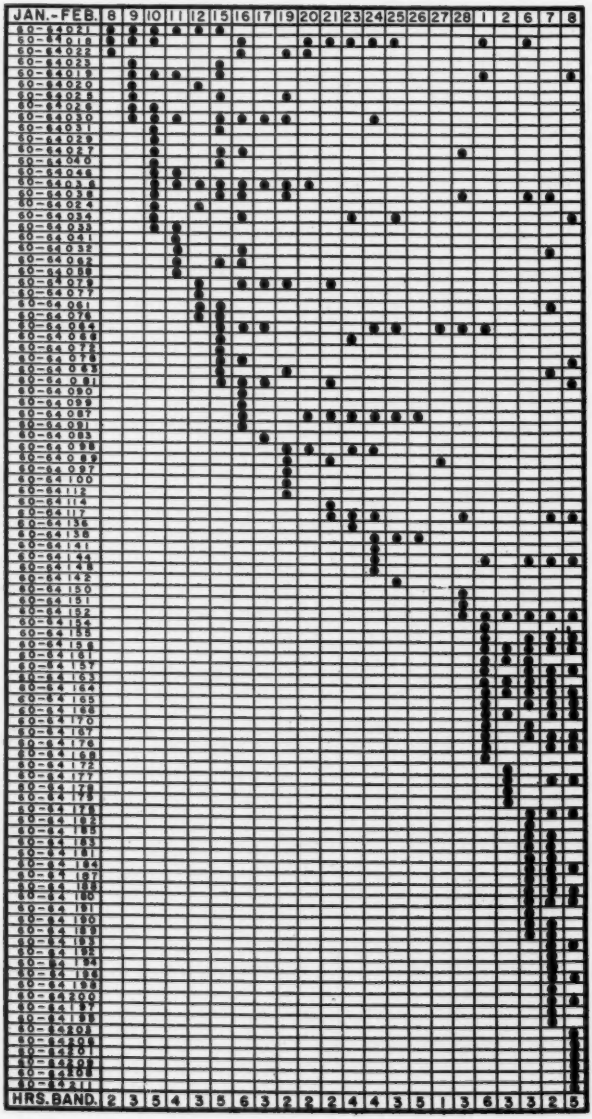

Table 3

New Birds and Repeats During Four Periods of Banding at Station A

	Periods			
	I	II	III	IV
	Jan. 8-12	Jan. 15-17	Jan. 19-25	Jan. 26-Feb. 2
Number of New Individuals	25	22	15	10
Repeating Individuals from Period I	—	15	6	7
Repeating Individuals from Period II	—	—	4	2
Repeating Individuals from Period III	—	—	—	3
Estimated Number of Individuals in the Area*	—	62	118	114

*See text for method of estimation.

The data from station A were analyzed similarly. Table 3 shows the number of new birds and repeats occurring in four periods, again divided on the basis of approximately equal banding time. The estimated numbers were almost constant in periods III and IV, but the ratio of new birds to repeats in period II was far lower than would be expected from random sampling of 114-118 individuals in the area (chi-square value at least 8.82). Thus, it again appears that the traps were attracting changeable groups of Tree Sparrows throughout the periods.

This evidence for changeable groups of Tree Sparrows appearing at the traps at both stations implies that the flocks making up these groups were unstable, since no new groups were noted without a number of repeating individuals and no old groups ever entirely disappeared. This evidence for flock instability in Tree Sparrows supports the observations of Heydweiller (1935) and Wallace (1942) of flocks which were changeable in composition and numbers.

An alternative explanation of the variability in the "Lincoln Index" estimates might be that the samples were not of adequate size. However, it seems to me that the samples were not so small as to invalidate the highly significant chi-square values obtained.

The Occurrence of Tree Sparrows in Relation to Snowfall. Although no definite correlation between snowfall and the total rate of capture of Tree Sparrows was found, influxes of new individuals often occurred following snowfalls. Figure 3 shows the rate of capture of new birds and repeats in relation to snowfall at station C. From the figure it can be seen that the rate of capture of new birds per hour only once markedly exceeded repeats per hour. This was three days after the snowfall of January 28-29, during the period, previously noted (Fig. 2; Table 2), of a marked influx of new birds.

On a number of other occasions, a similar influx of new birds occurred following a snowfall. No Tree Sparrows were trapped at any of the stations until after the four-inch snowfall of December 10 or the seven-inch snowfall of January 7-8. On January 23 a large group of new birds appeared at station A; it had snowed a total of about three inches during six of the previous eight days (cold weather kept the snow

Fig. 3. Fluctuations in the daily rate of capture of new birds and repeats at station C. Snowfall amounts are shown by the rectangles.

on the ground). An influx of new birds at Arcadia occurred one day after the five-inch snowstorm of February 7-8.

Since ground-feeding birds may be forced to wander considerably during periods of snow in order to find food (Wallace, 1955), some of the influxes noted in the present study probably represent wandering groups or individuals from areas where the food supply had been covered. If this was the case, it would explain some of the changing composition of the flocks about the stations. It is to be noted that Baumgartner (1938) correlated wanderings of Tree Sparrows with midwinter storms.

Tree Sparrows Occurring Together. On 74 occasions at station C, two or more birds were caught together in the same trap. Of the 292 pair combinations represented, 19 were noted twice. Of 65 similar pair combinations at station A, one was noted twice. No two individuals were trapped with each other more than twice. No correlation between the birds occurring together twice and their original banding dates could be found. It would appear that two birds never occurred together in the same trap more often than would be expected by chance or as a result of severe weather conditions driving large numbers of birds into the traps frequently.

Likewise, birds originally banded together on the same day showed no tendency to repeat together on succeeding days. On 17 days, two or more Tree Sparrows were initially banded at station C. However, when these birds repeated, they did so 72% of the time on a day when no other birds with which they were originally banded repeated. Birds initially banded together at station A repeated alone 56% of the time thereafter. This tendency for birds initially banded together to repeat singly on succeeding days became more noticeable as the number of days following the initial bandings increased. This suggests that if new

individuals represented groups of wandering birds on some occasions, they seemed eventually to amalgamate with the birds already present at the stations and to become individual members of the population, rather than to retain distinct subgroup affiliation. This, again, would better explain flock instability about the stations.

The Time of Day and the Occurrence of Tree Sparrows. There was no significant difference in the number of birds trapped per hour at each of the ten hours of the day during which trapping took place at both stations. When the observed number of birds trapped per hour at each of the ten hours was compared to the numbers expected if the birds occurred at random at all hours at station C, a chi-square value of 4.00 was obtained. A similar comparison gave a chi-square value of 6.43 for the birds occurring at station A. In addition, 90% of the birds occurring six or more times at both stations were caught during at least five different hours of the day.

These data suggest that the Tree Sparrow populations were not composed of flocks which had feeding circuits with fixed timetables. The occurrence of the Tree Sparrows with equal frequency at all hours of the day does not support the usual contention that Tree Sparrows are more likely to appear at feeding stations during certain times of day and not during others.

Wanderings of the Tree Sparrows

Figure 4 shows the direction taken and distance covered by Tree Sparrows which wandered one-half mile or more during January and February (not including birds released away from the station where

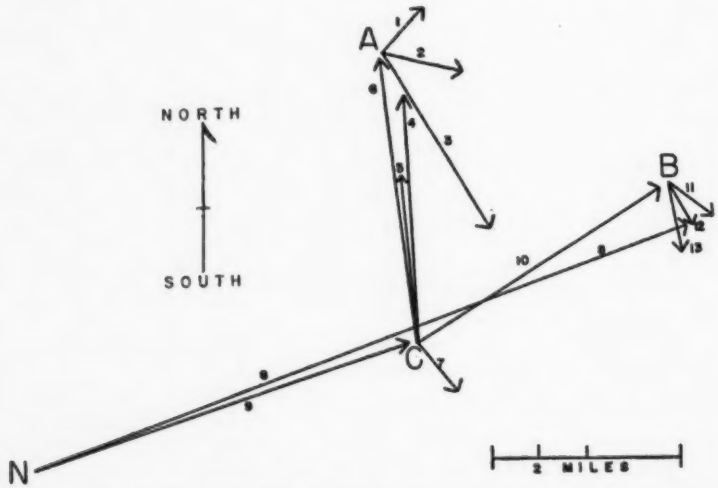

Fig. 4. Wanderings of the Tree Sparrows. The base of an arrow represents an initial point of banding; the tip represents a point of subsequent observation.

trapped). Table 4 gives additional data for these wanderings. Seven of the 15 individuals wandered over two miles. The longest distance a bird was known to have wandered was seven and one-half miles. These distances are to be compared to the maximum wandering of 6800 feet observed in Tree Sparrows by Baumgartner (1938).

Although the wanderings of the individuals considered in this paper were based on very reliable reports or on retrapped birds, some difficulties in observing the color-bands did arise in some other cases. The aluminum color-bands were very dark and a number of reports of black-banded birds were received. These reports were necessarily discarded. The pink plastic bands which were larger and brighter proved superior to the darker-colored aluminum bands. Occasionally reports were received of white bands on the right leg; these were, of course, regular Fish and Wildlife aluminum bands.

Since the chance of the observers spotting any one of the color-banded birds seems small (especially when it is realized that some of the observers could not be as systematic in making observations as would have been desired), it seems likely that considerably more wandering occurs in this species in the winter than was actually observed. It might also be noted that there were no observers in the directions west of stations A and C.

Snowcover forcing birds to wander in order to find food might explain influxes into the stations, as suggested previously, but wanderings from the stations are not so easy to explain. Feed was available throughout the entirety of each storm at each of the stations. Since Sabine (1949) has shown that a social hierarchy exists in Tree Sparrow flocks, it is interesting to speculate that overcrowding at the stations, with consequent social intolerance, forced individuals near the bottom of the social hierarchy to leave the area.

Of the birds wandering from station A, only those noted prior to the withdrawal of feed are considered here. The wanderings of birds from station A following the withdrawal of feed are briefly considered in the next section.

Table 4

Data on the wanderings of the Tree Sparrows

Number*	Number of Times Color-Banded Birds Seen	Maximum Number of Individuals at One Time
1	4	1
2	5	1
3	1	1
4	1	1
5	1	1
6	1	1 (retrapped)
7	23	2
8	1	1
9	3	1 (2 retrapped)
10	1	1
11	2	1
12	2	1
13	1	1

*coincides with number on Figure 4.

The Effect of Withdrawal of Feed

On February 6 all feed was covered at station A and feeding was not resumed until March 2. Although the red-banded birds no longer appeared at station A, the results were inconclusive. Actually, fewer observations of birds from station A were reported by the observers after February 6 than had been reported prior to that date. The area west of station A is largely open agricultural land, and it may be that the birds dispersed in that direction, where there were no observers.

"Homing" Data

On January 22, six birds were trapped at Arcadia Wildlife Sanctuary, banded with pink bands, transported the seven and one-half mile distance to station C, and released at 4:35 P.M. All of these birds had been originally banded at Arcadia, three of them during the previous winter. On January 24, one of these birds was observed back at Arcadia. Three of these birds were retrapped at Arcadia on February 9, and the same three were retrapped again on February 13 and 15. Pink-banded birds were observed at station C until January 26. On February 5 and 10 a pink-banded bird was observed at a feeder three and one-half miles from station C in almost the exact opposite direction from station C as Arcadia. I observed this bird on February 10.

On February 9, twenty birds were trapped at Arcadia, banded with yellow bands, and released at station C at 3:30 P.M. Nineteen of these twenty birds had not been trapped at Arcadia previously. Since fairly extensive trapping was carried on at Arcadia prior to February 9, these nineteen new birds seemed to be individuals which were driven to the trapping areas by the heavy snowfall of February 7-8. Yellow-banded birds were observed at station C until March 5, but none of these birds were observed or retrapped back at Arcadia, despite extensive banding activity.

Thus, although three of the first group of six returned to Arcadia, none of the second group of twenty returned. One difference between the two groups was the length of time that the members were known to have been in the Arcadia area. All three of the birds which "homed" had been trapped at Arcadia previously during the winter, and two of the three were originally banded there during the previous winter.

The explanation of "homing" based on the assumption that birds recognize familiar landmarks after exploration of an unknown area (Griffin, 1955), seems applicable to the results obtained. It has been shown that Tree Sparrows may wander considerable distances during the winter and certainly many landmarks could be learned. Thus, if a bird received a stimulus which could be satisfied by returning to a familiar area, learned landmarks might orient it. Since abundant food was available at the point of release, it seems possible that unfamiliarity itself was a significant factor in initiating "homing."

SUMMARY

1. Winter studies utilizing banding techniques were made on the Tree Sparrow in the Amherst area during the winter 1957-58.

2 The flock structure of the Tree Sparrow seemed unstable.

3. Snowfalls appeared to cause wanderings of the Tree Sparrows with consequent influxes of new birds into the banding stations.

4. No subgroup affiliations among the Tree Sparrows occurring at the stations could be found.

5. Tree Sparrows occurred with equal frequency at all hours of the day at the stations over a one month period.

6. Tree Sparrows wander considerably during the winter. Seven of fifteen wanderings exceeded two miles, the longest being seven and one-half miles.

7. Success in "homing" seems related to familiarity with an area. Unfamiliarity itself may be important in initiating homing.

ACKNOWLEDGMENTS

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THE USE OF MIST-NETS AND A HELIGOLAND TRAP AT POINT PELEE[1]

BY J. WOODFORD

In the spring of 1954 a full-scale Heligoland model trap was built at Point Pelee. The following spring limited use was made of mist-nets. Since then both the trap and nets have been used during the spring and fall migrations. This article is a report on the use of a Heligoland trap in North America, in conjunction with mist-nets, with a discussion of some of the relative merits of mist-nets and Heligoland traps.

LOCATION AND DESCRIPTION

Point Pelee, the most southern point of the mainland of Canada, is situated at the extreme southwestern portion of the province of Ontario. (Latitude 41° 54′ Longitude 82° 31′). It is 6 miles wide at the base and extends out into Lake Erie for about 9 miles. The general aspect is that of two long, low sandbars meeting at the apex, where they are joined for a little over two miles, and then stretching out in divergent lines to the main shore. A great deal of the point is swamp, of varying degrees of wetness. The eastern shore is a single sand dune, with some deciduous trees and undergrowth. The western side is wooded with deciduous trees and evergreens, principally black walnut and red cedar. A medium sized hardwood forest of oaks, walnut, and buttonwood has been set aside as a nature sanctuary. All in all there is a wide variety of habitat—cedar thickets, brushy tangles, marsh, ponds, sand dunes, open fields, beach and hardwood forest.

THE MIGRATION

Since the days of the Great Lakes Ornithological Club (Taverner and Swales, 1907-08) Point Pelee has been widely known as an excellent place to observe visible and resting migrants. The point seems to act as a natural "funnel", concentrating the birds as they move south towards the end of the point. A feature of the spring migration is the occurrence of "reversed migration," that is, birds moving south rather than north (Gunn, 1948). Over 60 species have been known to exhibit this behaviour. No entirely satisfactory explanation has been offered, but it seems to occur when the wind is from the south. Extra-limital birds, or strays, of southern or western distribution are sometimes observed at the point.

The fall migration is sometimes more striking than the spring. Large numbers of hawks, mainly Sharp-shinned Hawks, up to 1500 in one day, move through. In late September and October large concentrations of many species of sparrows occur.

THE HELIGOLAND TRAP

Heligoland traps have been described in detail by Brownlow (1952) and Williamson (1957). They are simply a tapering wire-netting enclosure, open at the wide end and closed at the narrow end by a

[1]Contribution number 3 of the Point Pelee Bird Banding Station, of the Ontario Bird Banding Association.

collecting-box, which has a transparent back, which appears to the birds which have entered the trap as a means of escape and induces them to enter the box. The Heligoland trap was originally developed from netting traps used by the Heligoland islanders to catch thrushes.

Description: The trap at Point Pelee follows the general plan in Brownlow*(op. cit.)* with minor changes to suit local conditions. (See Fig. 1). The original trap was described by Gunn (1954). Each year has seen some changes in the design as the result of experience. The site has been changed once and it seems likely that it will be changed again.

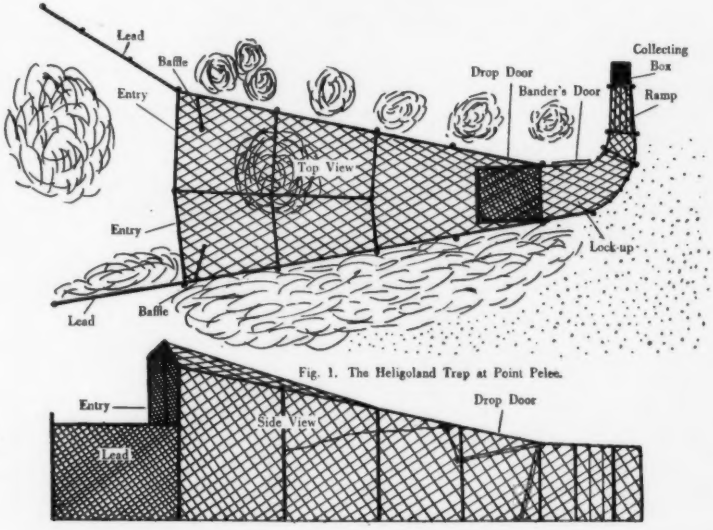

Fig. 1. The Heligoland Trap at Point Pelee.

The trap is 25 feet wide and 15 feet high at the entry. Over about 40 feet it tapers down to about 3 feet wide and 6 feet high at the collecting-end. The first 15 feet, from the entry, is covered with one inch wire-netting. The remainder is covered with one-half inch, with the exception of a part of the roof. A part of the area covered by one inch netting consists of two layers over-lapped.

On either side of the entry there is a wing or guide wall of one inch netting, about 8 feet high and 15 feet long. These tend to prevent some birds from by-passing the trap. For the first year there was no wing on the right side, a mist-net being set at right angles to the entry to intercept individuals which enter the trap and then attempt to fly back out. Just inside the entry there are baffles on either side which sometimes discourage birds which are trying to escape from the trap.

The lead to the collecting-box is curved to minimize "fly-back", that is, birds flying back out the entry rather than entering the collecting-box. The ramp leading to the collecting-box is made of rough lumber,

with "steps" of one by two inch strapping every foot. It is sloped up at about a 30° angle. Various sizes and shapes of collecting-boxes have been used. The present one is about two feet square and was constructed of five-eighths and one-quarter inch outdoor plywood. The back is sloped and grooves are cut in the sides to allow the glass back to slide in and out easily. Plexiglass was tried as a substitute for glass, but it discolored and was difficult to clean.

A shelf, extending to within two inches of the back, divides the collecting-box into two compartments. (See Fig. 2.) The birds enter the upper compartment and fly back to the glass. There they flutter against it and exentually slide down to the lower compartment. There are two exits, about six inches in diameter, in the side. Attached over these are collecting cages, about 6 by 8 by 15 inches, which have a door in the top so that the birds may be removed. If the birds do not enter the cages there is a "piston", which may be pulled across the lower compartment to reduce the area and force the birds into the collecting-cages.

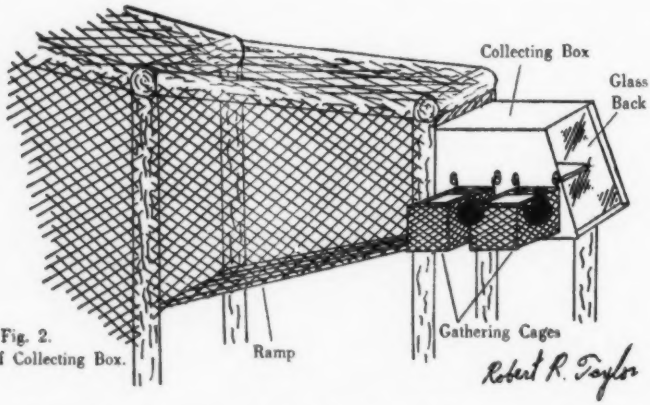

Fig. 2.
Details of Collecting Box.

About 8 feet from the curve of the collecting-end there is a drop-door, which is hinged at the roof and is controlled by a wire from near the entry. When a bird or birds have penetrated the trap as far as the lock-up the banders may lower the drop-door, thus confining the birds in a small area. If they do not enter the collecting-box a bander may enter the lock-up, via the bander's door, and drive the birds into the box or catch them by hand.

The original framework of the trap was one inch steel pipe. It was found that it was difficult to attach wire-netting to the pipe, so the pipe has been largely replaced by cedar posts as uprights and two-by-fours for cross pieces and braces. The doors are set into a framework so they will work easily and efficiently.

Operation: The trap is made operational by inserting the glass back in the collecting-box. There are then three alternatives open to the trappers: 1) the birds may be left to enter on their own, 2) they may be driven into the lock-up after they have entered the trap, and 3) a

"drive" may be made from several hundred yards up the point to the trap.

The first alternative is the ideal one, but often not too many birds are taken this way. This is due in part to the location of the trap. The second method is used when there is a good movement of birds down to the trap area. Often birds will enter the trap but then turn back. Two, or three, trappers may cover the entry and drive the birds towards the collecting-end by moving in quickly and clapping their hands or shaking the vegetation.

If there are few birds in the trap area a "drive" may be organized. Three or four trappers take up positions, a few yards apart, in a reasonably straight line, several hundred yards up the point. They move forward slowly, "beating" the underbrush with a stick or clapping their hands. Too much disturbance tends to make the birds fly up and over the trappers. They are also more likely to break back if the trappers do not keep in line. When the trappers reach the entry a sudden rush may be effective in driving the birds into the lock-up. Two or three "drives" a day may produce good catches. Just before dusk is an especially good time. Thrushes, sparrows and some sparrows make up the bulk of the catches from "drives". Too many "drives" seems to "disturb" the birds and they may move out of trapping range.

The best times seem to be in the early morning and the evening, although some days birds may be taken all day. Sharp-shinned Hawks have been trapped when they have chased a small bird into the trap.

MIST-NETS

The Japanese mist-nets in use at Point Pelee are either 9 or 12.5 metres long, 2 metres high or wide and have 4 shelves. Silk nets have one and one-half inch stretched mesh and nylon ones two and one-half inch. The silk nets were used for general netting, while the nylon nets were sometimes used to take hawks, shorebirds and gulls. Low (1957) has discussed banding with mist-nets and the procedures at Point Pelee are similar in most respects except as noted below.

Setting the net: The net is supported between two 10-foot lengths of one-half inch steel thinwall electrical conduit, which have been cut in half and are joined by a standard connector. The shelf-string loops are slipped over the conduit and the last (or top) one is looped so that it does not slip down easily.

In setting the net the bottom half of the pole is driven into the ground and the top section, with the net attached, is set in place. The bander then walks slowly away letting out the net. When the net is unfurled the bottom half of the second pole is pushed in and the top set in place. The shelf-string loops are then adjusted as is the distribution of netting.

In taking the net down all the loops are pushed up near the top of pole number one. Then the loops on pole two are pushed up and the top section is lifted off. The bander then walks back towards pole one looping the net in his hands, like a lasso, keeping the remainder taut so that it does not billow and occasionally pulling the mesh towards him so that it is not bunched at one end. The top halves, with the net attached, are laid on a three-foot square of plastic sheeting. The

TABLE 1. Species and individuals taken in mist-nets and the Heligoland Trap, Spring and Fall, 1956-57.

	Spring		*Fall*	
Species	*M.N.*	*H.T.*	*M.N.*	*H.T.*
Sharp-shinned Hawk	1		95	23
Yellow-billed Cuckoo	1	1	1	
Black-billed Cuckoo	1		9	1
Ruby-throated Hummingbird	6	4	23	14
Red-headed Woodpecker	1	1		
Downy Woodpecker			1	2
Eastern Kingbird	12	3	1	
Yellow-bellied Flycatcher	3	2		
Empidonax spp.	36	16	14	6
Eastern Wood Pewee	3	1	4	5
Tree Swallow	25	3		
Bank Swallow	458	82		
Barn Swallow	93	24		
Cliff Swallow	3	1		
Blue Jay	5	2	18	13
Red-breasted Nuthatch			2	4
Winter Wren	2	4	2	1
Catbird	26	13	19	8
Wood Thrush	4	1		
Hermit Thrush	3		11	3
Swainson's Thrush	23	13	85	74
Grey-cheeked Thrush		1	62	27
Veery	5	6	4	
Blue-gray Gnatcatcher	1	5		3
Golden-crowned Kinglet	6	4	3	
Ruby-crowned Kinglet	12	3	8	1
Cedar Waxwing			2	1
Solitary Vireo	4	1	1	
Red-eyed Vireo	21	10	5	3
Philadelphia Vireo		2	4	1
Warbling Vireo	4	2		
Black-and-white Warbler	4	10	3	
Tennessee Warbler	5	1	1	
Orange-crowned Warbler		1		1
Nashville Warber	19	8	1	1
Yellow Warbler	23	19	9	1
Magnolia Warbler	24	11	14	5
Cape May Warbler		8	1	
Black-throated Blue Warbler		2	2	
Myrtle Warbler	3	2		1
Black-throated Green Warbler	7	10		2
Cerulean Warbler	2	5		
Blackburnian Warbler	3	9	1	
Chestnut-sided Warbler	12	20	2	
Bay-breasted Warbler	1	7	1	
Blackpoll Warbler	1	1	31	15
Palm Warbler		1	10	6
Ovenbird	15	16	8	4
Northern Waterthrush	1	3	4	8
Mourning Warbler	3	2	3	
Yellowthroat	3	1		1
Yellow-breasted Chat	1	2	1	
Hooded Warbler	1	1		
Wilson's Warbler	2	5	4	1
Canada Warbler		5	4	2
American Redstart	2	5	17	5
House Sparrow	1	3		
Redwinged Blackbird	7	5	4	
Orchard Oriole	2			1

Species	Spring		Fall	
	M.N.	*H.T.*	*M.N.*	*H.T.*
Baltimore Oriole	8	5	2	
Common Grackle	1	1	3	
Scarlet Tanager	11	9		
Cardinal	1	1	14	2
Indigo Bunting	3	5	7	
American Goldfinch	3	2	3	1
Rufous-sided Towhee	2	2	1	
Savannah Sparrow	1	4		
Slate-colored Junco	35		3	6
White-crowned Sparrow	37	29	14	
White-throated Sparrow	8	8	23	2
Lincoln's Sparrow		5	2	
Swamp Sparrow		3	16	
Song Sparrow	6	3	17	1

bottom halves are collected and the whole thing is rolled up and tied—all ready to set up in a minute.

Net sites: Nets are used in a variety of situations. The most productive are across hedgerows or wild grape tangles. Lanes 3 to 4 feet wide are cut with machetes and garden cutters. Sometimes two nets are set in one lane—one set high, the other low. Some success has been had using nets at the top of 35 foot sections—the only problem being removing the birds. Nets are sometimes shifted to take advantage of local movements. An example of this was in May 1956, when severe cold weather forced many species, especially swallows, to feed along the beach. Several hundred swallows were taken in nets staggered along the beach. Up to thirty nets have been in operation at one time but the usual number is 6-12.

In April and October success has been had in catching sparrows by setting a line of about a dozen nets across an old orchard and moving the birds from one end of the orchard to the other. A number of shorebirds have been netted by setting nets along the beach, near the tip of the point at night. The best time has been from 11 p.m. to 3 a.m. A number of paths and roadways cut across the point on the west side; nets set along these have taken numbers of Sharp-shinned Hawks.

COMPARISON OF CATCHES

Information is available on 2,348 individuals as to whether they were taken in nets or the Heligoland trap. This is summarized in Table 1. Of these 1,647 were netted while 701 were trapped. Birds per trap and per net-hour, that is the trap operating for one hour or one net set for one hour, are 0.2 and 0.3 respectively. These totals represent about one-third of the 7,417 birds taken during the four years, 1954-1957 (Woodford and Wasserfall, 1958). A number of additional species were taken but definite information on them is not available.

Table 2 shows the catches by families. While the trends are similar the percentage catches are somewhat different. The trap is particularly effective for "ground" species, such as some of the warblers, thrushes and sparrows.

TABLE 2. Family percentages of birds taken in mist-nets and Heligoland traps.

Mist-nets		*Heligoland Trap*	
1—Hirundinidae	35.6%	1—Parulidae	28.5%
2—Parulidae	15.5%	2—Turdidae	17.8%
3—Turdidae	12.2%	3—Hirundinidae	15.7%
4—Fringillidae	12.1%	4—Fringillidae	13.9%

MIST-NETS VERSUS HELIGOLAND TRAPS

Williamson *(op. cit.)* has discussed the relative merits of mist-nets and Heligoland traps, when used on a wind-swept, barren island. He concluded that for general use traps were more productive, but nets should be available for emergencies—such as a rarity out of the trapping area.

There are many days at Point Pelee when the wind or rain severely limits netting activities. Several strategically located Heligoland traps would have greatly increased the daily catch. The best location for a Heligoland trap is along a low hedgerow or a fenceline where numbers of birds travel fairly regularly. A low entrance to the trap is desirable as the birds are less likely to fly back once they have entered. A trap in either of these situations would intercept the birds as they moved along and less "driving" would be necessary.

Some of the advantages and disadvantages of mist-nets and Heligoland model traps are listed in Table 3. Possibly the chief objection to the building of a Heligoland trap would be the initial cost—probably between two and four hundred dollars—and the time and labor involved. Most banding stations are manned by volunteers, who spend

TABLE 3. Some advantages and disadvantages of Mist-Nets and Heligoland Traps.

MIST-NETS

Advantages

1—portable
2—easily set up
3—large area may be covered
4—low initial cost
5—easily moved to take advantage of local movements

Disadvantages

1—affected by wind and wet weather
2—must remove each bird separately
3—must be taken down (or furled) when not attended
4—birds may lose feathers (about to be moulted) or parasites

HELIGOLAND TRAPS

Advantages

1—more 'weatherproof'
2—made operational by inserting glass back
3—birds easily removed from collecting-box
4—not as frequent inspection needed—more time for observation, banding, etc.

Disadvantages

1—high initial cost and time needed for construction
2—fixed position—small area covered
3—need crew (2 to 4) to operate
4—upkeep—repairs, etc.

their holidays banding, and most of them naturally want to spend as much of the time as possible actually catching and banding birds.

However, as more and more permanent stations, with some paid personnel appear, such as the one on Nantucket (Dennis and Whittles, 1955), consideration may be given to the construction of Heligoland traps. There is a point on Pelee Island which is overgrown with vines and tangles—most of which are under 10 feet high. During the spring migration it is literally covered by birds—350 were banded by two banders in one day—but due to the wind it is impossible to use nets about 85% of the time. One double Heligoland trap would take hundreds or thousands most springs. There are probably other places where one or two Heligolands would take good numbers, but where it is impossible to net every day.

So far most of the emphasis in North American banding has been to band large numbers in the hope of recoveries. As the recovery rate is very small more time may be spent examining individuals. At Fair Isle each bird is weighted, measured, examined for parasites, notes are taken on moult and many are identified to subspecies by comparison with specimens (Williamson, 1957). Emphasis is on catching, if possible, a number of birds each day rather than hundreds one day and none the next. The Heligoland traps produce birds even on windy, wet days when mist-nets would be useless.

The writer would be glad to discuss the building or use of Heligoland traps with any interested persons.

ACKNOWLEDGMENTS

I would like to thank Mr. Douglas D. Dow, Mr. Frank T. Lovesy and Mr. William Wasserfall for the use of field data and valuable suggestions and criticisms.

The Federation of Ontario Naturalists has provided financial support for the project for the years 1954-1957.

SUMMARY

1. A full-scale Heligoland model trap was built at Point Pelee in the spring of 1954. Both the trap and mist-nets have been used since 1955.

2. Data are available on 1647 birds netted and 701 taken in the trap.

3. These are listed by species and by families.

4. Relative merits of mist-nets and Heligoland traps are summarized.

5. Possibilities of building Heligoland traps in North America are discussed.

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c/o Royal Ontario Museum, 100 Queens Park, Toronto, Canada.

GENERAL NOTES

An Avian Predator Alarm of the American Robin.—Studies in and about Baltimore partly concurrent with those of Jackson in British Columbia *(Auk*, **69**: 466, 1952) support his finding that the high, thin, waxwing-like note of the Robin *(Turdus migratorius)* is an alarm note signalling the presence of an avian predator. I have also a few times seen Wood Thrushes *(Hylocichla mustelina)* give notes indistinguishable from the Robin's under circumstances suggesting that they had the same function. In "The Birds" (Univ. Mich. Press, 1958: 121) the Heinroths state that the European Blackbird *(Turdus merula)* uses "a repeated long, drawn-out 'Seeee'" to signal a flying enemy.

Further, I have once seen a Tufted Titmouse *(Parus bicolor)* give pretty similar notes, also under circumstances suggesting that they were avian predator alarms. Dixon *(Condor*, **51**: 116, 1949) records an apparently identical note of the Plain Titmouse *(Parus inornatus)* as a general fear note. Odum *(Auk*, **59**: 503, 1942) reports similar notes given by the Black-capped Chickadee *(Parus atricapillus)* "when a hawk appears or any large bird flies over or casts a shadow."

Have alarm notes of this nature evolved because they are inaudible to predatory birds? I can find no figures on the hearing range of hawks or Crows *(Corvus brachyrhynchos)*, but Edwards *(Auk*, **60**: 240, 1943) found that of another predator, the Great Horned Owl *(Bubo virginianus)*, to have an upper limit of about 7,000 cycles, and Brand *(Auk*, **55**: 266, 1938) found the range of Cedar Waxwing *(Bombycilla cedrorum)* song to be about 7,675 to 8,950 cycles.

Robin. In my suburban study areas hawks are seldom seen; here the Robin's note, which I have recorded as *eeee* and *eeeea*, signals the presence of Crows, and until Jackson made his report, dealing with hawks, I had believed it to be specific for Crows. I, too, have found that it is given almost exclusively during the nesting season—seldom, indeed, until first broods begin to leave the nest—and that fledglings, and sometimes other adults, "freeze" throughout the period it is given, which one one occasion that I timed ran to 15 minutes. The note has also sometimes seemed to cause Robins that were foraging on lawns to fly up into trees.

Observations on color-banded birds also confirm Jackson's finding that the note is given by both sexes. I have timed the rate, when it is being given steadily, at 8 to 12 notes a minute. It is given, from either the ground or a perch, when a Crow comes within about 90 yards or less, and whether the Crow is skulking through the trees, feeding on the ground, or simply passing overhead. In many trials at a number of Robin nests, I have been able to provoke the note only very rarely and very briefly by placing a mounted Crow near, or even directly beside, the nest, during the building, laying, incubating and nestling periods. Apparently, then, the alarm is directed primarily at fledglings out of the nest but not yet independent, and warns of an avian predator large enough to carry off a bird that size.

Five times that I have seen Screech Owls *(Otus asio)* being scolded, and twice that I have seen Sparrow Hawks *(Falco sparverius)* being pursued in the air, by Robins, it has been with the loud *peep* calls, not *eeee's*. Neither Blue Jays *(Cyanocitta cristata)* nor Common Grackles *(Quiscalus quiscula)* evoke *eeee's*. (The Robin also has a shorter and much fainter *eee* note, audible for only a short distance in contrast to the good carrying power of the predator alarm. I hear this second *eee* oftenest in late summer. It is given, just once or twice, when the bird is surprised by the sudden appearance near it of another bird, a beast or a human, or from uneasiness when the beast or human approaches or watches it too closely. It is also frequently given by one Robin upon coming near my feeding shelf and finding another Robin already there.)

Wood Thrush. I have seen color-banded Wood Thrushes of both sexes give *eeee* notes like the Robin's predator alarms, from both the ground and perches. As stated above, I could never tell what evoked these notes, but one male frequently glanced upward while uttering them, and two incidents showed their alarm character: once a male Wood Thrush stopped singing while they were being given, and once an incubating female looked about alertly during a series of them. Whether they were being given by a Wood Thrush or a Robin on those occasions I do not know.

Tufted Titmouse. Once a color-banded female titmouse on my feeding shelf "froze" in a position looking a bit upward, and at irregular intervals gave clear, thin, moderately loud *see, see-see* and *see-see-see's.* Then, after something more than a minute, she dashed away without taking a seed. Along with that bird, a male titmouse, a pair of White-breated Nuthatches *(Sitta carolinonsis)* and two Blue Jays had been coming to the feeder on each other's heels for many minutes, but now the place was deserted for five minutes.—Hervey Brackbill, 2620 Poplar Drive, Baltimore 7, Maryland.

Drumming by Female Hairy Woodpeckers.—There are few published reports of drumming by female woodpeckers in this country. Brackbill (1953, *Bird-Banding* **24**: 18) states that female Downy Woodpeckers, *Dendrocopus pubescens,* drum as well as the males, thus settling the disagreement in Bent's *Life History* (1939. *Bull. U.S. Nat. Mus. 174:* 54, 61.) In the same note, Brackbill records drumming by female Flickers *(Colaptes auratus)* and Red-headed Woodpeckers *(Melanerpes erythrocephalus),* but does not mention the Hairy *(Dendrocopus villosus).* Likewise, in the separate accounts of thirteen *D. villosus* subspecies, Bent *(op. cit.:* 13-44) describes drumming many times without indication that female Hairys participate. Furthermore, in an examination of literature published since Bent, no reference to female drumming in the Hairy could be found.

During the spring of 1957, with the kind help of Dr. William H. Drury and Carl W. Helms, the author color-banded five Hairy Woodpeckers for preliminary behavior observations in the field, at the Hathaway School of Conservation Education at Lincoln, Massachusetts. During that spring one banded and one unbanded female Hairy were seen drumming, and drumming was also witnessed in female Downy Woodpeckers and Flickers, thus supporting Brackbill's observations. Dr. Lawrence Kilham, who is now conducting extensive research on the behavior of Eastern North American woodpeckers, tells me (pers. comm.) that his notes are full of observations of drumming by females of these and other species. Apparently drumming by the female of the species is a common but overlooked behavior trait in most, if not all, of our woodpeckers.—Jack P. Hailman, 4401 Gladwyne Drive, Bethesda, Maryland.

RECENT LITERATURE

BANDING

(See also numbers 12, 13, 14, 15, 71)

1. Bird-banding. (Ringmärkning.) Viking Olsson. 1958. *Vär Fågelvärld,* **17**: 103-109. With more and more people banding birds in Sweden, carelessness in handling birds is increasing correspondingly. This timely resumé of some do's and don't's for the field-bander might well prevent the loss of many valuable contributions to our knowledge of birds through mishandling and ineptitude. When banding in a sea-bird colony, climb to the highest point of the land so that the young birds can see you! Their first reaction will be to "freeze" against the ground thus preventing needless exposure and scattering. Do not lift the bird unnecessarily, but band it as it lies on the ground or in the nest! Cover or turn their heads away from the bander in order to minimize the possibility of awakening the nest-leaving reaction in nestlings! Only one of them needs to jump out for the nest-clinging reaction in all the others to be inhibited. Above all, never risk the life or the welfare of a bird for the sake of a record!—Louise de K. Lawrence.

2. The Czechoslovakian Ornithological Society's Bird-Banding Report for the years 1943 to 1946. (IX. Beringungsbericht der Tschechoslowakischen Ornithologischen Gesellschaft über die Jahre 1943 bis 1946.) O. Kadlec and D. Basova. 1957. Published by the Krajske Museum, Jihlava, Czechoslovakia.

pp. 1-72. (In Czechish, with German summary.) Fills the gap in the publication of banding data caused by the suspension of the usual medium, *Sylvia*, during the war years. During those difficult times some 200 Czechs managed to band 93,344 birds of 174 species. The 62 pages of raw data for recoveries, returns, and repeats contain a few salient comments on their significance.—O. L. Austin, Jr.

3. Annual Report of the Bird Migration Station for 1957. (Jaarverslag van het Vogeltrekstation over 1957.) A. C. Perdeck, J. Taapken, J. H. Mook, J. Rooth, and J. J. Zijlstra. 1958. *Limosa*, **31**(2): 93-106. (From the English summary.) "At the fowling yard near the Hague 9184 birds of 42 species were ringed. A Snow Bunting ringed here on 23 Nov. 1956 was recovered in Iceland on 6 May 1957. A short preliminary description is given of the pairing behavior of the Great Skua, which was studied in Shetland. At the isle of Vlieland methods for catching waders were tried. Among others, 120 Dunlins were ringed."—O. L. Austin, Jr.

4. Bird-banding in Norway 1956. (Report No. 7.) Holger Holgersen. 1957. Sterna, **2**(5): 137-184. As three-fourths of the Norwegian banding is of fledglings or downy young, bad weather and a poor breeding year reduced the 1956 totals (24,056) some 7,600 under those for 1955. The long list of *gjenfunn* received in 1956, wisely culled of short-distance recoveries, short-time returns, and repeats, is composed mostly of water birds, cormorants, geese, waders, and gulls predominating. Of special interest migratorily are a *Crocethia alba* from Greenland, a *Larus fuscus* from southern Russia, a *Motacilla alba* from the Black Sea, and several *Jynx torquilla* from continental Europe. For longevity are a 13½-year *Circus cyaneus*, a 12½-year *V. vanellus*, a 9½-year *Arenaria interpres*, and a 13-year *Larus canus*.—O. L. Austin, Jr.

5. Results of the ringing investigations instituted by the Royal Museum of Natural History, Leiden, 53 (1956), 1. *(Resultaten van het* ringonderzoek betreffende de vogeltrek, ingesteld door het Rijksmuseum van Natuurlijke Historie (voortgezet door het Vogeltrekstation) te Leiden, XLIII (1956), 1.) J. Taapken. 1958. *Limosa*, **31**(2): 156-187. Raw data for the recoveries received in 1956, from the loons through the hawks, by far the greater part of them for waterfowl—13 pages of *Anas crecca* recoveries, 8½ pages of *Anas platyrhynchos*.—O. L. Austin, Jr.

6. Bandings and Recaptures. (Baguements et Reprises.) L. Hoffmann. 1956. *Troisieme compte rendu d'activite et Recuil des travaux*, Station Biologique de la Tour du Valat, pp. 12-48. The Tour du Valat Station has been in operation since 1950, using Paris Museum bands. The totals for its first 6 years are 29,956 birds of 164 species banded, 24,919 as adults, the rest as nestlings or downy young. From these they have had 6,692 returns and repeats, 1,430 recoveries. Leading the list are 7,571 *Anas crecca*, which have yielded 819 recoveries. Presented here are the raw data for returns and recoveries received in 1956, with brief comments on their significance. Three maps show the distribution of the Teal recoveries.—O. L. Austin, Jr.

7. A five-year banding study of the Takahe *(Notornis mantelli* Owen). G. R. Williams and K. H. Miers. 1958. *Notornis*, **8**(1): 1-12. Summarizes the knowledge gained to date from the banding started in 1952 of this handsome New Zealand gallinule, formerly known from only three specimens and feared extinct, but miraculously rediscovered in 1949 still extant in the wild mountain fastnesses of South Island. The main, largest, and most concentrated colony seems static at about 50 adult birds, 30 of which have been marked with both aluminum and colored plastic bands. As the species shows no gross sexual dimorphism, birds of known pairs are sexed "provisionally" by a combination of culmen and weight measurements. Observations of the banded population have shown: "Pairs of takahe show year-round territorial behavior and extended attachment to the area they occupy—frequently lasting over a number of years. The size of this occupied area lies between 15 and 45 acres. . . . Usually takahe appear to pair for life and this bond persists throughout the year. . . . Both birds of a pair take part in incubation; the breeding age is one year in at least some birds; double brooding and renesting are known."—O. L. Austin, Jr.

8. On the attitude of adult birds toward their young banded in the nest. (Du comportement des oiseaux adultes vis-a-vis leurs jeunes bagues au nid.) R. Arnhem. 1957. *Le Gerfaut*, **47**(4): 237-240. Having watched a female Blackbird, *Turdus merula*, try vigorously to remove the shiny band just placed on one of her nestlings, the author speculates on the causes and possible consequences. He suggests that some parents, because of their instinct to keep the nest clean and free of nestlings' feces and other foreign objects, will try to remove the band. The instinct is so strong that if the band does not slide off the fledgling's leg and the fledgling is not too large, they may carry the fledgling away with it. He believes this to have been the fate of several small nestlings he banded that disappeared prematurely, and warns that young should not be banded until they are too large to carry away. However, he describes one case in which a *banded* female Blackbird apparently paid no attention to the bands on her young.—O. L. Austin, Jr.

MIGRATION

(See also numbers 56, 68, 71)

9. Bergmann's Rule and Obligatory Overseas Migration. Kenneth Williamson. 1958. *British Birds*, **51**(6): 209-232. Bergmann's Rule states "that in a polytypic species the body-size of a subspecies tends to increase with the decreasing mean temperature of its habitat." The author examines this rule in relation to length of migration overseas of land birds nesting in Greenland and Iceland, and finds it most strikingly born out in the Wheatear *(Oenanthe oenanthe)*. "The migration-pattern at Fair Isle, and occurrences in the North Atlantic, show that trans-oceanic flights of 1,500-2,000 miles may be undertaken in cyclonic weather, resulting in a weight-loss considerably greater than the typical race could endure." Four tables present weights and measurements of Greenland, Iceland, and Continental Wheatears, and 10 maps show weather conditions at sea during migrations of Wheatears. "Among Icelandic birds the effect is most strongly marked in the Redwing, Merlin and Redshank, whose migratory flights into the British area may exceed 1,000 miles under cyclonic conditions." Other species show less of this "migration-influence"; some of them make a comparatively short migration to North America, while the Meadow Pipit and White Wagtail "may be comparatively recent and still expanding colonists in the northwest."—M. M. Nice.

10. The annual fluctuations in the migration of the Honey Buzzard over Falsterbo. Report from Falsterbo Bird Station No. 11. (De årliga fluktuationerna i bivråkens *(Pernis apivorus)* sträck över Falsterbo.) Staffan Ulfstrand. 1958. *Vår Fågelvärld*, **17**: 118-144. (English summary.) This paper is based on a study of the Falsterbo migration records of the Honey Buzzard for the past 10 years and the fall migration of 1953 and 1955 in particular. During these two fall periods, the Honey Buzzard appeared in more than double its average annual numbers. Moreover, while its migration period in 1953 occurred at the normal time, the one in 1955 was 3 weeks late. Neither population increases through either immigration or good nesting success, nor possible changes in the breeding range, nor the influence of the summer temperature on the timing of the migratory impulse can account for the deviations convincingly. The wind conditions, on the other hand, i.e., the relation between concentration-favoring and inhibiting winds, determined the numbers of these birds and the time when they soared across the skies over Falsterbo. The student of bird migration is warned to look deeply into the intricate relationship of the great variety of factors influencing the movements of a certain species, not the least important of which is the pattern of behavior. The entire study is comprehensibly reviewed in the English summary.—Louise de K. Lawrence.

11. Arrival dates of the Swift (Apus apus) in Germany 1953-1957. (Die Erstankunft des Mauerseglers in Deutschland 1953-1957.) Herbert Bruns. 1958. *Ornithologische Mitteilungen*, **10**: 61-65. This report supplements an earlier one *(Orn. Mitt.*, **5**: 61-70) covering the years 1948-1952 and, like it, is based on data obtained from many observers throughout Germany. The present report covers the 10 years from 1948 to 1957 for which 1019 first dates of arrival were available. Temperature, weather, and altitude are all shown to affect the arrival date, each as would be expected.—R. O. Bender.

12. The avifauna of Stora Karlsö in 1957. (Stora Karlsös fågelfauna under 1957.) B. Flach and R. von Schultz. 1958. *Fauna och Flora*, (1-2): 9-38. The comprehensive reviews furnished in recent years by the senior author on the birdlife of this strategic island in the midst of the migration routes across the Baltic Sea are important contributions, especially when considered in relation to the Ottenby and Falsterbo reports. During the unusually cold period March through May, many insectivorous birds succumbed to starvation. A warm air mass developing over southeastern Europe in the end of May drove a number of migrants northwesterly, resulting in an invasion of birds at Stora Karlsö. Many of these could be identified as young birds which, having not yet become imprinted upon a particular territory, were apparently stimulated by the warm air and the prevailing good visibility to prolonged migration. Other interesting observations were made on the deviating effect of the lighthouse beams upon the fall migrants flying southwest. The light attracted them out of course, but its rotating movement prevented any mass slaughter against the tower and the cliffs. Two nestling Guillemots *(Uria aalge intermedia)* banded 8 July 1957 were recovered, one on a salmon hook in Poland 2 December 1957, the other oil-killed at Bornholm 14 January 1958. Lack of space prevents quoting here many more data from this detailed report.—Louise de K. Lawrence.

13. A brief note on the pelagic migration of the Tubinares. Nagahisa Kuroda. 1957. *Misc. Rpts. of the Yamashina Institute for Ornithology and Zoology*. No. 11: 436-449. Kuroda shows on a world map how closely the migrations of oceanic birds follow the prevailing circulations of winds and currents in the major oceans. He suggests that while the seasonal regularity of their movements is controlled by the birds' "inherent physiological rhythms . . . the steady seasonal winds may act to orient their 'inherent impulse to migrate' to a fixed migratory direction." The paper lists the outstanding banding recoveries of Tubinares that indicate their postulated routes and is accompanied by a lengthy and comprehensive bibliography of source material.—O. L. Austin, Jr.

14. Notes on the Ringing and the Breeding Distribution of the Giant Petrel *Macronectes Giganteus*. Bernard Stonehouse. 1958. *Ibis*. **100**(2): 204-208. Reports 14 recoveries received (to October 1956) from 800 nestlings banded in the FIDS area (see *Bird-Banding*, **29**: 1) during the 1955-56 season and discusses their significance. Stonehouse agrees with Downes, Serventy, and others who have analyzed similar Giant Petrel recoveries from Australian bandings that the species' first-year movements are strongly influenced by the west wind drift, that they "tend to disperse eastward after fledging, and travel in a northeasterly direction across the west-wind zone." He also reviews sketchily from the literature the species' known breeding distribution and reports its first known nesting below the Antarctic Circle, on the Henkes Islets off the west coast of the Palmer Peninsula, which lie at 67°44′ South according to my maps (not 64°44′ as stated, which would put them more than 100 miles north of the circle instead of some 75 miles south of it).—O. L. Austin, Jr.

15. First Report of Banded Birds Migrating between Australia and Other Parts of the World. W. B. Hitchcock and R. Carrick. 1958. *C.S.I.R.O. Wildlife* Research, **3**(1): 54-70. A succinct analysis of avian migration within and to and from Australia is followed by a useful summary of the banding data connecting Australia with distant parts of the world. These now comprise 178 recoveries of 9 species. All but one species, a New Zealand freshwater duck, are sea birds and, except for Serventy's Shortailed Shearwaters (see *Bird-Banding*, **29**: 185), all were banded abroad and recovered in Australia. Most of the recoveries are for spectacular long distances, and they are shown graphically on three ingenious maps. Combining the data for several species on each makes the maps a bit cluttered and confusing, but they amply illustrate the authors' comments on the significance of the recoveries for each species.

The Giant Petrel, *Macronectes*, recoveries are strangely in inverse ratio to the numbers banded at each place, which the authors suggest is caused by "the position of the banding-centre in relation to potential recovery areas in which the probability of band-returns varies." Their tabular presentation of the monthly distribution of Giant Petrels banded as young and recovered at a distance, often on the opposite side of the world, is most revealing. The young birds seem to make a tremendous flight in leaving the nesting grounds, influenced and

helped by the strong westerlies as they move northward through them. They they tend to remain in a favorable locality in lower latitudes north of the westerly zone until they reach breeding age. "It does not seem necessary to postulate continuing circumnavigation of the globe, at least not by young birds." (See also No. 14.)—O. L. Austin, Jr.

16. Analysis of Mass Bird Mortality in October, 1954. David W. Johnston and T. P. Haines. 1957. *Auk*, **74**(4): 447-458. Conveniently summarizes all the usable data on the now famous bird kills at airport ceilometers, television and radio antennae, and tall buildings between 5 and 8 October 1954. Some of these are from the literature (six papers have been published on the event, most of them in minor journals), most of them are from a questionnaire sent to interested observers and from the authors' own investigation of the bird falls at Warner Robins A.F.B., Ga., which suffered the heaviest kill of all. They discuss the weather conditions that brought on the disaster and present data on weight, sex, age, fat deposition, and subspecific identity of many of the species involved.—O. L. Austin, Jr.

POPULATION DYNAMICS

(See also numbers 7, 24, 25, 26, 33, 45, 47, 50)

17. On the average age of the Blackbird. (Over de gemiddelde ouderdom van de merel *(Turdus merula* L.). R. Verheyen. 1958. *Le Gerfaut*, **48**(1): 5-14. (From the French summary.) Verheyen's analysis of 502 recoveries of Blackbirds banded as nestlings in Belgium shows that while the oldest bird reported lived slightly more than 7 years, the average life span (for whatever that vague concept tells us) is about 11 months. Of greater significance, the average annual mortality in the Belgian Blackbird population is about 67 percent, as against 42 percent shown by Lack for the same species in Great Britain. The age-compositions of the two breeding populations are also at variance; whereas the Belgian population comprises roughly 60 percent 1-year-old birds and 40 percent birds 2 years old and older, these figures are almost exactly reversed in the British population. This of course simply reflects their respective adult mortality rates.

Assuming that both the British and the continental Blackbird populations are maintaining themselves with approximately equal success, it follows that these demonstrated differences in mortality must be reflected by other aspects of their respective biologies, such as the slight difference in their average clutch sizes, 4.25 in Belgium, 3.9 in Britain. Verheyen thinks the Belgian birds compensate in part at least for their higher annual mortality by a first-year mortality no greater than that of subsequent years. Though his calculations seem to bear out this possible but improbable anomaly, I just cannot believe Belgian Blackbirds survive their first year any better in comparison to adult survival than young British Blackbirds or American Robins do. The fallacy probably lies in Verheyen's selection of his basic data, and he gives too little of and about these to permit reconstructing his tables in the standard format for recalculating by the standard methods adopted by Lack, Farner, Hickey, and others, none of which does he follow.

Of greater moment in the manifestly different population dynamics of the two populations, it seems to me, is their annual recruitment or replacement potentialities as shown not by average clutch size alone, but by the number of nestings each year and the fledging success in each population, which have yet to be investigated adequately.—O. L. Austin, Jr.

18. Sex ratios and mortality in nestling House Sparrows. (Geschlechterhältnis und Sterblichkeit der Nestlinge Haussperling.) Kurt Bösenberg. 1958. *Ornithologische Mitteilungen*, **10**: 86-88. Most sex ratios reported for adult *Passer domesticus* in the literature are close to 1:1. Over a 5-year period the author determined the sex of 397 nestling House Sparrows by dissection. The average male:female ratio for the entire period of 1.17:1.0 (ranging from 1.3:1.0 in 1953 to 1.0:1.06 in 1956) suggests that nestling mortality is higher in females, and it follows that fledgling mortality must be higher in males. Each pair fledged from 6 to 8 young per year. These studies are being continued.—R.O. Bender.

NIDIFICATION AND REPRODUCTION

(See also numbers 8, 18, 38, 46, 47, 50, 55, 67)

19. On the initiation of the incubation in the Blackbird. (Om ruvningens igångsättande hos koltrast *(Turdus merula).*) Anders Enemar. 1958. *Vår Fågelvärld,* **17:** 81-103. (English summary.) As all papers I have read by this author, this one distinguishes itself by the meticulous care and objectivity with which his observations are made and his conclusions drawn. In order to determine the actual start of incubation of the individual eggs, three aspects of the egg-laying process were investigated: 1) the contact between the bird and the egg during night-sitting, 2) the average heat of the eggs, 3) the reaction of the embryo. Often from the laying of the second egg the Blackbirds began sitting on the nest at night. True incubation usually started before the laying of the last egg. During the night-sitting and from the start of incubation, the birds sat deeply pressed down into the nest-cup at all times so that there was no question of "token" incubation among these Blackbirds. Furthermore, the warming of the eggs thus accomplished was sufficient to start embryonic development. By means of candling the eggs, the beginning of the heart-beat was determined to the hour, showing distinctly the succession in which the eggs were laid and incubation started even in clutches more or less completed when found. The English summary is descriptive and informative.—Louise de K. Lawrence.

20. Birds nesting in or on structures. (Vom Nisten verschiedener Vogelarten an und in Gebäuden.) Herbert Ringleben. 1958. *Vår Fågelvärld,* **17:** 109-118. (From the Swedish summary.) With most of the records coming from Germany, more than 30 species have been found nesting in or on buildings. Among these are jays, nuthatches, creepers, titmice, thrushes, swallows, ducks, doves, and gulls. The author points out the possibility of following the evolutionary process of this change in ecological requirement. Not all of these species are cliff-dwellers originally. In the cliff-dwelling species no ecological evolution has actually taken place. No "pressing circumstances" appear to have existed for eliciting such behavioral alterations.—Louise de K. Lawrence.

21. Egg-size variation in the Grey Starling, *Sturnus cineraceus* Temminck. Nagahisa Kuroda. 1958. *Tori,* 14 (70): 1-17. (In Japanese with English summary.) A statistical analysis of the measurements and weights of 100 eggs (87 in 17 first clutches, 13 in 3 second clutches) obtained from nest-boxes. Variations in shape, size, volume, and weight are correlated with size of clutch, sequence of laying, and time of laying. Weights were found to decrease slightly during incubation, but the rate of decrease varied considerably in individual eggs.—O. L. Austin, Jr.

22. Notes on the Breeding of the Iceland Gyr Falcon. Philip Wayre and G. F. Jolly. 1958. *British Birds,* **51**(8): 285-290. The authors visited six eyries of *Falco rusticolus islandus* and spent 40 hours in a hide 10 meters from one that contained 2 eyasses about a month old. All 6 kills brought were cock Ptarmigan, *Lagopus mutus.* Apparently the tiercel did most of the hunting and he also fed the chicks himself on four of the visits. He "was more gentle with the youngsters than the falcon was, and appeared to take far more trouble in tearing up the food."—M. M. Nice.

23. The Feeding of Nestling St. Kilda Wrens. T. B. Bagenal. 1958. *Bird Study,* **5**(2): 83-87. Counts for 11 and 14 hours on two nests shows the young were fed between 20 and 30 times per hour, instead of 10 to 13 times per hour as previously reported for this insular subspecies. As this approximates the feeding rate in the continental race *(T.t.troglodytes),* "it cannot be said that the St. Kilda Wren lives in such a bleak habitat that food shortage significantly increases the time necessary for foraging. . . . The role of the two sexes in feeding the young was approximately equal except for the early morning and late evening when the female did the greater share. The St. Kilda Wren, like other insular races, is believed to be less polygamous than the European Wren, and this would appear to be reflected in the large amount of feeding done by the male."—O. L. Austin, Jr.

24. Observations on the Breeding of the Kittiwake. J. C. Coulson and E. White. 1958. *Bird Study*, **5**(2): 74-83. Excellent statistical data on the nesting phenomena of *Rissa tridactyla*, based on counts and observations in one colony (see No. 25) through four breeding seasons. Incubation periods in 119 successful nests varied from 23 to 32 days, with a mean of 27.3 ± 1.3 days. The fledging period for 116 chicks averaged 42.7 ± 4.4 days, with a minimum of about 36 days. The fledging periods of single and paired chicks did not differ significantly. The mean size of 149 clutches was 2.01 eggs; brood size at hatching averaged 1.82 chicks. "The breeding success of the colony was 56% between egg-laying and fledging of young, 1.14 young being fledged per breeding pair. The average daily increase in weight of chicks between 100-300 g. was 16 g. There was no difference between the growth rates of broods of one and two chicks, and no difference between the growth rates of older and younger birds in broods of two chicks." In view of the apparent recent increase in the Kittiwake population on the east coast of Great Britain, it would be interesting to compare these figures on reproductive success and potential recruitment with figures on later mortality, particularly in the breeding population.—O. L. Austin, Jr.

25. The Effect of Age on the Breeding Biology of the Kittiwake *Rissa tridactyla*. J. C. Coulson and E. White. 1958. *Ibis*, **100**(1): 40-51. Another fine paper in the series these authors are producing on their Kittiwake studies. This one is based on a small population of birds the authors were able to trap and color band at their nests on the window ledges of a riverside warehouse in Northumberland from 1954 through 1956. Their observations on these aged and sexed birds confirm their earlier postulate that older Kittiwakes react "to the breeding stimulus earlier, more intensively and with greater success than younger breeding birds. Birds with previous breeding experience returned to the colony before birds breeding for the first time and these before non-breeders." They found Kittiwakes show both colony tenacity and nest-site tenacity strongly and, as we found with the terns years ago, the trait becomes stronger with age. Surprising, to me at least, is their discovery that while slightly more than half the birds retained the same mates in subsequent years, the remainder changed mates each year. The authors analyze all their data statistically and show them to be of extremely high mathematical significance.—O. L. Austin, Jr.

26. The Breeding of the Blackbird *Turdus merula* at Oxford. D. W. Snow. 1958. *Ibis*, **100**(1): 1-30. The results of a detailed 4-year study of two populations of Blackbirds, one nesting in the Oxford Botanic Garden, the other in the broad-leaved woodland of a neighboring estate. "Old females averaged 3.1 broods per year, yearling females 2.3. Breeding begins later in woodlands than in gardens." Clutches averaged slightly smaller in the garden population, and yearling females laid smaller clutches than older ones. Hatching success was 90 percent in the garden population, 92-95 percent in the woodland, but reproductive success was much lower in the woodland birds because of heavy predation to the nestlings. "The garden population has produced an average of 4.1 young per pair per year, and 66% of them have survived to independence. . . . It is probable that at least 62% of the young that reach independence survive to the next breeding season." The paper also contains many useful data on incubation, feeding and rate of growth of the young, and dispersal of the young after they leave the nest, and discusses these aspects of breeding biology in relation to weather conditions.—O. L. Austin, Jr.

27. The Significance of the Colour of Turdine Eggs. David Lack. 1958. *Ibis*, **100**(2): 145-166. Analysis of egg color in the Holarctic and Indian species of Turdinae shows this character to be of no taxonomic significance. "Instead, certain colours of eggs tend to be associated with certain types of nesting site; species nesting in deep holes tend to have immaculate white eggs; those in shallower holes and niches speckled white, immuculate blue or speckled blue eggs; those on the ground, amid herbage or on ledges obscured brown, grey or olive eggs; those in forks in bushes or trees blotched eggs, often with shadow-marks, on a bluish or white ground; those building domed nests immaculate or speckled, white or blue, eggs." Lack considers these colors adaptive. "The immaculate white eggs of hole-nesters perhaps result merely from the absence of selection by predators, but more probably are adapted to increase the visibility of the eggs to the parents in a dim light. Obscured brownish or

olive eggs are adapted for concealment on the ground or amid herbage." He gives considerable space to refuting Cott's theories (see *Bird-Banding*, **24**: 76) on the significance of palatability in passerine eggs and gives strong evidence showing that "palatability is not correlated either with colour of eggs or with nesting sites as such, and hence that the species most vulnerable to predation have not evolved especially distasteful eggs, and that the eggs of small passerine species are not warningly coloured."—O. L. Austin, Jr.

28. Notes on Breeding Colonies of the Red-billed Quelea in S. W. Tanganyika. Desmond Foster Vesey-FitzGerald. 1958. *Ibis*, **100**(2): 167-174. Notes on incubation, clutch size, hatching, feeding of young, and daily activity of parent birds in *Q. quelea* made in nesting colonies in the Rukwa Valley. The size of these colonies—the largest one studied "covered about 93 acres and contained about 2½ million nests"—affords some idea of the magnitude of the economic problem posed by these grain eaters in agricultural Africa.—O. L. Austin, Jr.

29. Nest-site Selection, Pair Formation and Territory in the House—Sparrow *Passer domesticus*. D. Summers-Smith. 1958. *Ibis*, **100**(2): 190-203. Observations of color-banded birds from 1951 to 1957 in two study areas, one rural the other suburban, lead the author to conclude "that once House-sparrows have bred they remain faithful to their mates and nest-sites for life. Exceptions to this faithfulness to nest-site may occur in areas where suitable sites are plentiful, when the pair may hold two sites and use these indiscriminately for breeding. . . . Pair formation most frequently occurs by replacement when one bird of an established pair dies. . . . Bigamy appears to be uncommon. The House-sparrow is a colonial nester and territorial behavior is limited to defence of the nest-site. The factors of importance in these aspects of the life of the House-sparrow are: sexual dimorphism, sedentary behavior and use of fixed sites for nesting. Colonial nesting is considered to have arisen from the bird's feeding habits and sedentary behavior; it is maintained by the method of pair formation."—O. L. Austin, Jr.

30. Life History of the White-whiskered Soft-wing *Malacoptila panamensis*. Alexander F. Skutch. 1958. *Ibis*, 100(2): 209-231. Detailed first-hand observations on this little known and seldom studied Central American species, presented in the author's simple direct prose, which to me is always a pleasure to read. Most of this paper deals with the species' nesting habits, but it also contains excellent notes on its appearance, voice, and general behavior. —O. L. Austin, Jr.

31. The incubation rhythm of the female Pied Flycatcher *(Ficedula hypoleuca)* in the presence and absence of the male. Lars von Haartman. 1958. *Ornis Fennica*, **35**(2/3): 71-76. Incubation in this species is entirely by the female. She is fed frequently on the nest by the male, but she also leaves the nest at short intervals to forage for herself. When the male of a pair was removed experimentally at the start of incubation, the female's periods on and off the nest were greatly extended, especially the off-periods. "The total amount of incubation decreased from about 79% to 58%. The weight of the female decreased from 16.0 to 14.2 gm. These findings confirm that the food given by the male is of real importance in the nutrition of the female during the incubation period."—O. L. Austin, Jr.

32. Observations on the Incubation Behavior of a Common Nighthawk. Milton W. Weller. 1958. *Auk*, **75**(1): 48-59. A female *Chordeiles minor* nesting on an exposed roof, oriented her body on clear days "along the axis of the sun's rays with her head away from the sun. On cloudy days, or when artificially shaded, she did not orient. Her head was more sensitive to the sun than her body." In temperatures that ranged up to 61° C. (142° F.) she cooled herself by "panting, facing away from the sun, and fluffing the feathers." As has been noticed in the terns and other species that nest in exposed places, incubation is of more importance in keeping the eggs from cooking on hot sunny days than in warming them during cool weather. This bird cooled her eggs as much as 15° C. at midday and warmed them some 5° to 6° at night. She moved displaced eggs with her bill, feet, and breast feathers; the young were able to move themselves in response to her call the first day after hatching.

The male was not seen to incubate, but helped feed the young from the day they hatched until after fledging, and apparently "assumed responsibility for feeding the young of the first brood while the female incubated the second clutch." —O. L. Austin, Jr.

33. Relation of "Clutch-size" to Number of Ova Ovulated by Starlings. David E. Davis. 1958. *Auk*, **75**(1): 60-65. By serial sectioning their ovaries the author determined the number of eggs 32 female *Sturnus vulgaris* ovulated. Comparison with the number of eggs in the nest box of each bird showed more ovulations in 16 cases, fewer in 9, the same in only 7. Loss of eggs is easy to account for; excesses may result from two females laying in the same box. As Davis points out, "the fact that clutch size is not necessarily an indication of number of eggs ovulated means that interpretations of the biological implications of changes or differences in clutch-sizes need to be examined carefully." But while number of ovulations is unquestionably a sounder measure of reproductive potential than clutch size, it is a far more difficult figure to obtain, and what counts demographically is not the number of young a species is capable of producing, but the number it produces that mature to breed in turn.—O. L. Austin, Jr.

34. Notes on the Breeding Habits of *Panyptila cayennensis*. F. Haverschmidt. 1958. *Auk*, **75**(2): 121-130. Describes the nesting of a pair of Scissor-tailed Swifts against the stone wall of a house in Paramaribo, Surinam. This paper, with No. 35, provides detailed information on the roosting and breeding habits, particularly on nest construction in this interesting species.—J. C. Dickinson, Jr.

35. Distribution and Nest of *Panyptila cayennensis* in Brazil. Helmut Sick. 1958. *Auk*, **75**(2): 217-220. See comment on No. 34.—J. C. Dickinson, Jr.

BEHAVIOR

(See also numbers 7, 8, 23, 30, 39, 46, 63, 65, 66, 67, 68, 69)

36. The Display of the Manakin *M. manacus*. Iris Darnton. 1958. *Ibis*, **100**(1): 52-58. To find as delightful a paper as this one in staid old *Ibis*, of all places, renews one's faith in the future of the British Commonwealth. Its contents aren't earth-shaking; they probably won't cause the slightest tremor even in the little world of behavioristic ornithology. Its main contributions are the observations that these manakins make individual dancing grounds in close proximity to one another on the forest floor in which each pair goes through a dance ritual early every morning, and that the series of unbirdlike sounds, one like a twig snapping, another like a nail drawn over a comb, are made by *both* sexes during the dance. How the birds produce the sounds has yet to be explained satisfactorily, though evidence suggests they doubtless make some of them with their wings, not the syrinx.

The paper's outstanding features are its freshness, simplicity, and clarity. To describe what she saw during a month in Trinidad spent most profitably watching the manakins go through their antics, the author uses refreshing Anglo-Saxon one- and two-syllable words, a minimum of technical terms (most of those quoted), and no behaviorist jargon whatever. Her opening sentence sets the tone for the entire piece: "The Black and White Manakin *Manacus manacus* is a cobby little bird about four inches long, common in the forests of Trinidad." As she develops her narrative and argument from that perfect start, you don't have to be a behaviorist nor even an ornithologist to understand and to enjoy every word of it. This to me is scientific writing at its best.—O. L. Austin, Jr.

37. Further Notes on Pairing and Submissive Behavior of the Red-legged Partridge *Alectoris rufa*. Derek Goodwin. 1958. *Ibis*, **100**(1): 59-66. "1. The submissive display is described. It is sometimes given when the bird appears to be simultaneously frightened and attracted by a fellow member of the species. 2. The pairing behavior of some individual captive birds is described. Some degree of mutual fear and hostility seems to be a necessary correlate of sexual attraction in this species. Birds that know and are at ease with one another do not pair. 3. A young male showed (in autumn) behavior similar to that of a female ready to pair when introduced to an old and aggressive male. A possible biological function of such behavior is suggested." No comment.—O. L. Austin, Jr.

38. Territorial and Other Behavior of the Woodpigeon. S. Cramp. 1958. *Bird Study*, **5**(2): 55-66. The author studied *Columba palumbus* for some 8 years, mainly in the parks of central London, where this usually wary and wild species is "both surprisingly tame and numerous." He describes pair formation and nuptial display in detail. Birds establish territories in early winter and maintain them through the breeding season; they proclaim ownership "by song and display flight to some extent, but mainly by the male's continued presence for long periods and by his driving off all trespassers." The function of territory "appears to be to provide a safe place where the pair-strengthening displays and coition can take place without interference. It also helps to ensure sufficient nesting sites for a species which often makes many repeat attempts in one season." —O. L. Austin, Jr.

39. An Investigation on the Courtship of the Red-crested Pochard. (Eine Untersuching über das Balzverhalten der Kolbenente *(Netta rufina* Pallas).) With English summary. Hans Lind. 1958. *Zeitschrift für Tierpsychologie*, **15**(1): 99-111. Observations on 4 males and 1 female in the Copenhagen Zoo. Courtship consists of 4 distinct phases; these are described and illustrated. "It is shown that there is probably no special courtship drive, but that the courtship activities are 'still' dependent on the original drive combination (attack, fleeing and sexual drive). This combination is ritualized so that only a variation in strength of the three drives within definite 'limits' results in courtship. Besides, every courtship activity corresponds to a relative strength of the three drives which is also ascertained by the ritualization. Finally, some remarks are made on the ritualization of the displacements."—M. M. Nice.

40. Behavior of the European Nuthatch. (Das Verhalten des Kleibers *(Sitta europaea caesia* Wolf). (With English summary.) Hans Löhrl. 1958. *Zeitschrift für Tierpsychologie*, **15**(2): 191-252. This excellent study covers the same field as the more popular account by the same author previously reviewed in *Bird-Banding* (**29**(3): 207), to which review the reader is referred. The present paper treats the same material with more detail and discussion and with citations to a long bibliography. The color-ringed Nuthatch population of 36 acres was watched for 5 years and the behavior of the birds carefully investigated. Fifteen calls of different significance are described. "The male's red flank-feathers are spread conspicuously when it is sexually excited but are generally hidden during threat display. In low-intensity fighting, males tear off pieces of bark and pull leaves to shreds. This displacement activity may develop into real feeding. The females join actively in the fighting and even attack males."

Three observations of 12 to 15 hours on 2 incubating females showed that Female F's average period on the eggs was 21.2 minutes and off the eggs 8.8; Female S's periods averaged 33.5 minutes on and 22 minutes off. Female F, incubating 70 percent of the daylight hours, hatched her eggs in 15 days, while S, spending 64 percent of the time on the eggs, hatched hers in 18.5 days. The young are brooded for 15 to 20 days; they leave the nest at 24 days, well able to fly. Eight to 10 days later they are independent. A notable contribution.—M. M. Nice.

41. Mixed Bird Flocks in Mexico, in Particular the Behavior of Northern Migrants. (Gemischte Vogelverbände in Mexiko, insbesondere das Verhalten nordischer Zugvögel.) Helmut O. Wagner. 1958. *Zeitschrift für Tierpsychologie*, **15**(2): 178-190. Local birds usually stay in families within the winter flocks. The migrants benefit from the sedentary birds' knowledge of good places for sleeping, eating, and refuge. "Adverse environmental factors increase the flocking tendency." Some hummingbirds breed in Alaska and Mexico—in summer and winter quarters. In April 1939 300 Painted Buntings *(Passerine ciris)* were caught in the state of Veracruz and 10 to 15 percent of the young birds had thick, bright bill swellings, evidently having recently left the nest. No further details are given.—M. M. Nice.

42. On the social behavior of Pheasants. (Zum sozialen Verhalten des Jagdfasans.) Kaj Westerskov. 1958. *Ornithologische Mitteilungen*, **10:** 84. The author comments briefly on the winter flocking behavior of the Pheasant *(Phasianus colchicus)* in New Zealand. Although unisexual winter flocks are common in the Northern hemisphere areas, in New Zealand three-fourths of all the Pheasants observed in the winter were alone, and one-fifth were seen in unisexual groups which averaged only 2 to 3 birds.—R. O. Bender.

43. Notes on the Courtship Behavior of the King Rail. Brooke Meanley. 1957. *Auk*, **74**(4): 433-440. The male *Rallus elegans* attracts a mate mainly by uttering the mating call and by exposing his white under tail coverts. During the nuptial phase of courtship the mated pair have a series of more subdued calls and utter the mating call less often. "The mating call and several other calls uttered by the King Rail . . . sounded identical to those given by the Louisiana Clapper Rail *(Rallus longirostris)*. . . . Further investigation of the habits of these two closely related species would possibly reveal many other identical behaviorisms."—O. L. Austin, Jr.

44. Notes on the Behavior of the Flying Steamer Duck. M. Moynihan. 1958. *Auk*, **75**(2): 183-202. Describes in behaviorist terms and some detail the "considerable variety of hostile and sexual behavior patterns" in *Tachyeres patachonicus*. Some of these patterns remind the author of those "of sheld-ducks and sheld-geese; but the other displays are peculiar enough to suggest that the relationship between the Steamer Ducks and the typical Tadornini is fairly remote. It may be better to put the Steamer Ducks in a separate tribe of their own, the Tachyerini."—O. L. Austin, Jr.

WILDLIFE MANAGEMENT

(See also numbers 28, 67)

45. On the population changes in birds during the hunting season. T. Udagawa. 1957. *Misc. Rpts. of the Yamashina Institute for Ornithology and Zoology*, No. 11: 458-460. (In Japanese with English summary.) The author made daily censuses of the birds observed near a Tokyo suburb for 2 weeks, starting 4 days before the hunting season opened. Small song birds such as sparrows, wagtails, titmice, and white-eyes showed no significant changes in numbers, but the populations of two species hunted commonly, the Jay *(Garrulus)* and the Bulbul *(Microscelis)*, declined markedly.—O. L. Austin, Jr.

46. Local Movements of Wood Ducks *(Aix sponsa)*. Paul A. Stewart. 1958. *Auk*, **75**(2): 157-168. Intensive field observations of female wood ducks and their broods in central Ohio, aided by color-marking and banding, showed that after leaving the nest the broods usually remain near the natal site for the first 2 weeks and then move to new habitats at varying distances up to 3.5 miles, often forming congregations of five and six broods. "When lost from the female, very young ducklings did not show their normal fear and followed various moving animals and objects. At such times they readily joined Wood Duck broods other than their own, and some mixing of broods thus occurred." When the young are about 6 weeks old, the females start gathering into small groups. When the young start to fly at 8 weeks, further population shifts occur, resulting in further congregating in late summer on ponds and lakes. "Birds at the congregation centers did not move but furnished the nuclei of the congregations." About the first of October, the birds move from the ponds "usually less than 15 miles" to rivers and creeks. The southward migration takes place in late October and early November.—O. L. Austin, Jr.

47. The Eider-Duck population of Vlieland. (Het aantal Eidereenden *(Somateria mollissima)* bij Vlieland. J. en C. Hoogerheide. 1958. *Limosa*, **31**(2): 151-155. (From the English summary.) The Eider population of this barrier island off the northeastern Netherlands coast was about 12,000 birds in 1957, the number of nests about 3,000. Counts at the start of the breeding season showed the sex ratio to be 1 to 1. The presence of 1,500 to 2,000 1-year-old birds attested the success of the 1956 breeding season.—O. L. Austin, Jr.

48. Seasonal, geographical and yearly trends in the weight of capercaillie *(Tetrao urogallus)* and blackgame *(Lyrurus tetrix)* in Finland. Jukka Koskimies. 1958. *Ornis Fennica*, **35**(1): 1-18. This scholarly analysis of 3,659 Capercaillie and 4,498 Blackgame weights shows the variations caused by sex, age, season, locality, and year. Males are heavier than females in both species; all sexes and age groups gain weight from September to a November peak and then start to lose gradually. "Blackgame show a consistent trend of increasing weight from south to north [Bergmann's rule]. . . . With capercaillie,

the southernmost populations are heaviest and the central ones lightest on the average. It is probable that the former are influenced by a large southern race *(Tetrao urogallus major)* and the latter by a smaller eastern one *(T. u. uralensis)*. The northern populations are intermediate in weight, probably representing the nominate race *T. u. urogallus*. There are year-to-year variations of about 5-10% in the average weight of the period October-December. The yearly weight level is in inverse relation to the average temperature of the same period."—O. L. Austin, Jr.

CONSERVATION

(See also number 16)

49. Notes on the Black Stork *Ciconia nigra* in Japan. Haruo Takashima. 1957. *Misc. Reports of the Yamashina Institute for Ornithology and Zoology*, No. 11: 431-435. (In Japanese with English summary.) This species has led a precarious existence since the turn of the century in both Japan and Korea. One or two wintered regularly with the cranes at the Arasaki sanctuary in Kyushu until the Korean war, during which its last known nesting site in Kyongsang Pukto was probably destroyed, for none has been reported since. It is all too likely that man has succeeded in extirpating the eastern Asiatic population of this fine bird.—O. L. Austin, Jr.

50. The Exploitation of Sea Birds in Seychelles. M. W. Ridley and Richard Percy. 1958. *Colonial Research Studies*, No. 25 (Her Majesty's Stationery Office, London): i-viii, 1-78. Price 12s. 6d. This timely report on the current status of the sea birds nesting on the group of islands north of Madagascar is based on an extensive field survey made in 1955. It gives a history of the century-old egg industry which, though declining rapidly, is still of considerable economic importance to the inhabitants of this British colony, and short accounts of the biology and ecology of the two species principally involved, the Sooty Tern, *Sterna fuscata*, and the Noddy, *Anous stolidus*. Its statistics show how greatly all species have declined, particularly the Sooty Tern which, though it has always borne the brunt of the egging, is still the most numerous species. In discussing the birds' many natural enemies it points out: "it would be a mistake to suppose that any factors other than man are responsible for their decline in numbers, or that the removal of all the birds' natural enemies would have more than a very small effect on the numbers of birds returning to breed each year."

During their survey the authors conducted a series of experiments on Desnoeufs Island, the largest ternery (1,210,000 Sooties, 18,300 Noddies), to learn something of the effects of egging on renesting. Their studies of dyed and color-banded adults showed: Not all Sooty Terns lay a second egg after removal of the first; a few renest on other islands; it takes the species an average of 14 days to re-lay after its egg is removed, and this period remains the same regardless of the stage of incubation and whether the egg is smashed or removed; the Sooty Tern will sometimes lay a third egg after the removal of the second; Noddies take much longer than Sooties to re-lay after losing their first eggs. The appendices contain useful notes on the reproductive system and the embryology of the Sooty Tern, pictures of eggs and embryos in various stages of incubation, and comments on the effects of storage on edibility.

Most important are the authors' studied analysis of the conservation problem and the strong measures they deem mandatory to protect the valuable natural resources of the Seychelles to maintain their yield. They recommend protecting all birds and their eggs except the two terns, prohibiting the export of wild bird plumage, and making certain islands inviolate sanctuaries. They advise reducing the tern egg harvest drastically and discuss ways of accomplishing it, such as by cropping only half the occupied territory each year alternately, varying the closed season dates, or by allotting quotas. They also recommend limiting the harvest to fresh eggs for use within the colony, prohibiting the export of egg yolks, eliminating the appalling wastage of smashing eggs to ensure fresh ones later, and the keeping of adequate statistics on the egging trade and on the bird populations that make it possible.

Enforcing conservation laws on remote islands is always difficult and poaching is notoriously hard to control when its profits are high, but the examples of Laysan, the Priblofs, and of the American coastal bird islands show conservation is not

only possible, but practical and profitable. It is earnestly to be hoped that the implementing action so necessary in the Seychelles will shortly follow the publication of this fine report, before it is too late for the Wideawakes and the other species that are so rapidly disappearing there.—O. L. Austin, Jr.

PARASITES AND DISEASES

51. Treatment of Sick and Wounded Birds. F. B. Lake. 1958. *Bird Study*, **5**(2): 66-74. This is a most helpful discussion of a problem that, as the author points out, often embarrasses almost everyone known to be interested in birds—what to do with the sick, wounded, exhausted, or otherwise helpless live birds that people bring you. It describes the common ailments encountered, tells which illnesses and injuries are curable and how to cure them, which ones are hopeless and how best to put the suffering bird out of its misery. It gives common sense advice on how to cage and feed different kinds of birds and describes their varying reactions to confinement. The advice on what to do with nestlings, "perhaps the commonest thing one has to deal with," is particularly apt: return the bird to its parent if at all possible, if not "hand rearing may be undertaken." I'm sure I for one will often have occasion to refer to this useful paper.—O. L. Austin, Jr.

PHYSIOLOGY AND PSYCHOLOGY

(See also numbers 32, 33, 48, 68)

52. Body Temperatures in California and Gambel's Quail. George A. Bartholomew and William R. Dawson. 1958. *Auk*, **75**(2): 150-156. Data gathered on captive *Lophortyx californicus* and *L. gambelii* show a "conspicuous diurnal cycle of body temperature that is correlated with level of activity. . . . These quail resemble birds of other groups in their storage of heat at high ambient temperatures. Their demonstrated tolerance of body temperatures as much as 4°C. (7.2°F.) in excess of normal levels appears to be of primary importance in their survival in hot environments."—O. L. Austin, Jr.

MORPHOLOGY AND ANATOMY

(See also number 59)

53. The Beard of the Wild Turkey. A. W. Schorger. 1957. *Auk*, **74**(4): 441-446. The author discusses the results of detailed gross and microscopic examination of the beards of 5 races of *Meleagris gallapavo*. The original purpose of this study, separation of domestic and wild specimens, provided negative results. The Schorger investigation presents data (somewhat meagre in terms of numbers of specimens involved) which indicate that there is no noticeable geographic variation in the number, length, or cross-sectional shape of the bristles of this species. The conclusion that "the beard is a poor sex character," based on the presence of beards in 8.9 percent of 120 domestic turkey females and in 7.4 percent of 230 pen-reared females of wild stock, seems unwarranted on the basis of data presented for wild-killed birds, for which Schorger quotes McDowell's (1954 Ph.D. Thesis, Va. Poly. Inst.) figure of 4 out of 557 females with beards.—J. C. Dickinson, Jr.

54. Comments on the Phylogeny and Skull of the Passeriformes. M. Jollie. 1958. *Auk*, **75**(1): 26-33. The relative development of the prefrontal bone in various oscines indicates to the author that "the large species of this suborder, as represented by the crows, are the more primitive while the small species are the more specialized. Other features of the skull suggest that the passerines may not be the most advanced of birds." His introductory comment that "at this time . . . we need to know how to interpret information . . . as much as we need new information" seems particularly apt.—O. L. Austin, Jr.

ZOOGEOGRAPHY

(See also numbers 7, 13, 14, 15, 41, 49, 67, 70, 71)

55. Name List of the Netherlands Birds. (Naamlijst van de Nederlandse Vogelsoorten.) First report of the Commissie voor de Nederlandse Avifauna (Netherlands Chick-List Committee). 1958. *Limosa*, **31**(2): 107-119. (From

the English summary.) A list of the scientific and approved Dutch vernacular names for the 350 species the committee recognizes as occurring in the Netherlands. Subspecies are not mentioned. Also indicated are the 184 of these for which the Committee considers sufficient proof exists of breeding in the Netherlands since 1900.—O. L. Austin, Jr.

56. Occurrence of the Red-flanked Bluetail *(Tarsiger cyanurus)* in Finland and some remarks concerning its expansion to the west. Matti Helminen. 1958. *Ornis Fennica,* **35**(2/3): 51-64. During the past decade this central and eastern palearctic species has extended its range across the Ural barrier into northeastern Finland. "There is some evidence that warm springs have stimulated the spring migration of the species and caused its prolongation."—O. L. Austin, Jr.

57. Remains of Rare and Extinct Birds from Illinois Indian Sites. Paul W. Parmalee. 1958. Auk, **75**(2): 169-176. A very rewarding study of avian remains from Indian sites dating back to the A.D. 1550-8000 B.C. periods. New and interesting records of a variety of forms are presented.—J. C. Dickinson, Jr.

58. Photographic Studies of Some Less Familiar Birds. LXXXIX. Goshawk. I. C. T. Nisbet. 1958. *British Birds,* **51**(6): 233-237. *Accipiter gentilis* breeds both in the Old and New Worlds, but is little more than a vagrant in Britain. It has long been used for hawking. They "were regularly used in Persia and India for hunting such large game as cranes *(Grus* sp.), Great and Houbara Bustards *(Otis tarda* and *Chlamydotis undulata)* and Gazelles *(Gazella subgutterosa)*." Studies on its prey under natural conditions are summarized. "The species has only one serious enemy—Man, in his rôles of falconer, game-preserver, chicken farmer and 'sportsman'." There are 6 fine photographs of adults and young in Sweden taken by Kurt Ellstrom and Jonas Svensk.—M. M. Nice.

SYSTEMATICS

(See also numbers 48, 54, 55)

59. Convergence or paramorphogenesis. Systematics and phylogeny of the Penguins. (Convergence ou paramorphogenèse. Systématique et phylogénie des manchots (Sphenisciformes).) R. Verheyen. 1958. *Le Gerfaut,* **48**(1): 43-69.

Since in the view of the author a satisfactory solution to the problem of the evolution of the orders of birds may not be reached by the traditional methods of taxonomy, he proposes a new means to determine whether similarities be due to convergence or separate phyletic lines or to paramorphogenesis, the parallel development of structures inherited from a common ancestor among its related descendants. If the amount of similarity is very low, resemblances are said to be due to convergence. If the similarities are numerous, the forms are thought to have retained from a common ancestor an identical structural basis.

A review, from the literature, of the morphological and physiological characters of the penguins occupies 18 pages and is accompanied by a useful bibliography. Original factual material includes a table of skeletal ratios of 11 forms based on a total of 20 specimens. Unfortunately raw measurements are omitted. Osteological diagnoses of the six genera are given. The number of species recognized is 13, although apparently the author did not study some of the forms reduced to synonymy.

The penguins are said to agree with the Procellariiformes in 52 percent of 208 taxonomic characters and with the auks in 54 percent of these characters. We are not told just what these points of agreement are. Furthermore the skeletons of the diving petrel *(Pelecanoides urinatrix)* and the dovekie *(Plautus alle)* are identical in 65 percent of 105 unenumerated particulars.

From the application of this new method in the study of evolution the preposterous conclusions reached by the author are: 1) the penguins are as closely allied to the auks as they are to the petrels. 2) The diving petrels should be removed from the Procellariiformes and placed in the order Alciformes. 3) The

penguins, auks, and petrels had a common origin from semiaquatic coelurosaurian reptiles, distinct from the line leading to other birds. From this common ancestor one branch led to the penguins, which never passed through a volant stage, and a twin branch gave rise to the auks and petrels. 4) The fossil penguins may have had a different ancestor than had the living ones.

Let us hope that the author's lament that recent anatomical research has had no influence on systematics will prove true in the case of the theory of paramorphogenesis.—Pierce Brodkorb.

60. Field Observations Pertaining to the Systematic Status of the Great White Heron in the Florida Keys. Andrew J. Meyerriecks. 1957. *Auk* **74**(4): 469-478. Ever since 1858 when Spencer Baird gave the name "*Ardea wurdemanni*" to the hybrid produced by *A. occidentalis* and *A. herodias* the battle has raged. Meyerriecks joins forces with Mayr *(Auk*, **73**: 71-77) in presenting evidence that *occidentalis* and *herodias* are conspecific. Observations of behavior, variability, white : blue ratios, randomness of mating, and breeding season all lend additional weight in favor of this conclusion.—J. C. Dickinson, Jr.

61. Variation in the Great Horned Owls of Middle America. J. Dan Webster and Robert Orr. 1958. *Auk*, **75**(2): 134-142. The authors comment that *Bubo virginianus* is a difficult but interesting one for the taxonomist. They state the "complicating factors are: (1) the availability of relatively few specimens; (2) the existence of two and even three color phases in some areas; (3) considerable indifference to ecological conditions by the species as a whole, yet ecological constraint exhibited by local populations; (4) a network pattern of distribution of morphological characters, with some localized populations distinct, but surrounded by much larger areas where the populations are intermediate or different." It does seem that it might have been best to delay arrival at conclusions until the first (and only) removable objection had been removed. The value of conclusions on subspecific validity and relationships based on 4 *(B.v.mayensis)* and 11 *(B.v.mesembrinus)* specimens is certainly questionable. The third Middle American race these authors recognize is *B.v.pallescens*.—J. C. Dickinson, Jr.

62. Variation in South American Great Horned Owls. Melvin A. Traylor. 1958. *Auk*, **75**(2): 143-149. Traylor, as were Webster and Orr (see No. 61), was hampered in arriving at conclusions on the subspecies of *Bubo virginianus* in South America, but he had the advantage of a more equitable distribution of his specimens, and of course he studied variation over a much larger geographical area. Thus the diagnostic differences cited are much more marked than those outlined by Webster and Orr for their Middle American forms. Traylor concludes that *B.v.magellanicus, B.v.nacrutu*, and *B.v.nigrescens* are worthy of certain recognition. The status of *B.v.deserti*, of which only one specimen was available for study, is "tentative."—J. C. Dickinson, Jr.

EVOLUTION

(See numbers 27, 54, 59, 68)

FOOD

(See also numbers 22, 23, 26, 68)

63. Food and Feeding Habits of the Scaups in Connecticut Waters. John M. Cronan, Jr. 1957. *Auk*, **74**(4): 459-468. Analysis of the stomach contents of 119 *Aythya marila* and 10 *Aythya affinis* showed the former to eat 93.4 percent animal food, the latter only 61.7 percent. In both species molluscs are "unquestionably the favorite scaup food, but the particular molluscan species taken appeared to depend upon availability." The most important plant food is sea lettuce *(Ulva)*. Timing the dives of feeding scaup showed them to range from 9 to 33 seconds, with an average of 20.4 seconds. The birds usually feed in 5 feet or less of water; the greatest depth in which they were seen to feed was 23 feet.—O. L. Austin, Jr.

64. Studies of the bird population of a fruit orchard. (Untersuchung über die Vogelpopulation eines Obstgartens.) Johann Korodi Gal. 1958. *Ornithologische Mitteilungen*, **10**: 66-69. Late May censuses for two seasons in a mixed fruit orchard in Roumania showed 26 species nesting in the 8.5 hectare area, 12 of them migratory, 10 non-migratory, and 4 "temporarily present" (what the latter designation signifies is not clear). Data are presented on the food habits of young Great Tits *(Parus major)* obtained by the neck-band method.—R. O. Bender.

SONG

(See also numbers 30, 51)

65. Late Season Singing of the Yellowhammer. Noble Rollin. 1958. *British Birds*, **51**(8): 290-303. Three *Emberiza citrinella* in Britain (lat. ca. 55° N.) sang the following number of songs in one day: 1 August, 2,279; 5 August, 2,686; 5 August, 3,482. This last bird spent 12 hours, 11 minutes singing. A table and chart give the number of songs per hour for each bird, and another chart shows the times of beginning song from March to August; early singing occurred throughout June, July, and early August.

In Norway (between latitudes 63° and 69° N.) from 23 June on, Yellowhammers were singing much less than in Britain. "A bird in full song in the Arctic sang 488 songs in one day." Song ceased in July. "Factors thought to be connected with the lesser amount of song in higher latitudes were the continuous light, the lack of night sleep and the lesser amount of song competition." —M. M. Nice.

66. The Calls of the Chaffinch *(Fringilla coelebs L.)* in Denmark. H. Poulsen. 1958. *Dansk Ornithologisk Forenings Tidsskrift*, **52**(2): 89-105. Analysis of sound spectrographs or "sonograms" shows the calls of the British race are very similar to those of the continental race in Denmark except for minor variations in song and in one of the male alarm calls. The author divides the Chaffinch repertoire into 13 calls, each with a different meaning and "communicatory function."—O. L. Austin, Jr.

BOOKS

67. The Ring-necked Duck in the Northeast. Howard L. Mendall. 1958. *University of Maine Studies, Second Series*, No. 73, 320 pp. $2.50.—Since 1930 *Aythya collaris* has extended its range from the west and northwest to much of the northeast, being "especially numerous in Maine, New Brunswick, eastern Ontario and parts of Quebec." The present excellent volume is the report on one of the major research projects of the Maine Wildlife Cooperative Research Unit from 1943 through 1955. A thorough coverage of the distribution, migration, life history, food, hunting, and management is presented in 14 chapters, each with its summary, as well as in 10 appendices, a 14-page bibliography, 48 photographs, and a subject index. Not only is the Ring-neck fully discussed, but comparisons are freely made with other studies on ducks, chiefly North American.

Pair attachment and parental care are more pronounced in Ring-necks than in many other ducks. The drake stays by his mate practically to the end of incubation, while the hen "is one of the most devoted of duck mothers." "The feigning performance is the most intense and persistent that I have observed among any waterfowl in the northeast. The process may last as long as 10 or 15 minutes and take the female a half mile from her brood." In contrast to the majority of diving ducks, the Ring-neck customarily keeps her young with her until they have reached the flying age at 7 weeks.

Red-winged Blackbirds *(Agelaius phoeniceus)*, through their zeal in driving crows and ravens from the nesting marshes, are a definite help in saving eggs of Ring-necks and Black Ducks *(Anas rubripes)*. The average clutch size of 423 first nests of Ring-necks was 9, of 48 re-nests 7. The incubation period ranged from 25-29 days, averaging 26. Of 473 first nests 70 percent hatched, of 49 re-nests 61 percent. Brood counts averaged 8.4 at hatching and 5.2 when the ducklings were nearly grown. Thus nesting success and brood survival both reflect exceptional parental care.

As to management, the following measures are recommended: continuance of the regulations against hunting before October; habitat management on refuges, particularly control of water levels and exclusion of human visitors during the nesting season; predator control only under special conditions.

"This study began 21 years ago." The report is the product of the labors of many people as is shown by the acknowledgments that fill more than 6 pages. All in all, an admirable book, a storehouse of information about a fine species that is increasing and pioneering in new regions.—M. M. Nice.

68. Listening in the Dark. Donald R. Griffin. 1958. Yale University Press, New Haven, Conn. xviii + 413 pp. 16 plates, 15 figures, 12 tables. Price $7.50. One of the most intriguing classes of sensory phenomena known to the biologist is the use by certain animals, including man, of active sonic signals as a means of orientation. In this volume Donald R. Griffin has synthesized a great diversity of facts from the field of biology, psychology, and sound physics into a fascinating account of echolocation as a mode of perception among animals.

The major portion of the book (10 of the 15 chapters) deals with acoustic orientation in bats, for it is in these mammals, particularly the family Vespertilionidae, that echolocation mechanisms have evolved to a particularly high degree of perfection. For those unfamiliar with bats, the brief review of their structure, probable phylogeny, unique physiological characteristics, and general habits presented in the first two chapters will serve to provide a background against which the significance of their means of acoustic orientation can be fully appreciated.

Scientific attention was first focused on the question of how bats avoid obstacles when flying in the dark by the incisive experiments of Spallanzani and Jurine in the late 1700's, but it was not until 1938 that the intense ultrasonic sounds emitted by bats were first heard by Griffin and Pierce, although Maxim and Hartridge had hypothesized some years before that bats employed sounds beyond the range of human hearing for orientation. By about 1945 sufficient data had been accumulated through careful experiments and critical observations to indicate beyond all reasonable doubt that bats of the family Vespertilionidae at least can indeed orient themselves by means of high frequency sounds and that vision is of little importance.

Subsequent research on bat echolocation has been concerned with the precise nature of the sounds produced, the structural and functional adaptations of laryngeal and auditory mechanisms for the generation and reception of these sounds, and the actual role played by echolocation in the lives of diverse types of bats. In the course of seven chapters Griffin details the painstaking field and laboratory experiments by which these and other aspects of acoustic orientation in bats have been and are presently being explored, the acoustical principles involved, and the biological significance of the results. Among the many interesting facts that have thus far emerged from these investigations has been the discovery of several distinctive patterns of sound orientation in bats which are correlated with particular structural and behavioral adaptations. With the exception of *Rousettus*, the species of Megachiroptera that have been studied are strictly visual animals. In the absence of light or when blindfolded *Rousettus* is able to switch from visual to sonic orientation. Its sounds are short audible pulses ranging over a broad band of frequencies, and their production is so fundamentally different from that in the Microchiroptera as to suggest an independent origin of echolocation in the two suborders of bats.

The species of Microchiroptera studied fall into two major groups on the basis of the type of sounds produced. The "loud" bats generate pulsed sounds having considerable energy, and in the most specialized of these the pulses are frequency modulated. These bats are all insectivorous, with the exception of the partially piscivorous *Noctilio*, and evidence strongly favors the fact that some of them actually employ echolocation to hunt down insects in flight. The "whispering" bats are typically fruit eaters or carnivores that feed on relatively large prey. Their pulses have only from 1/100th to 1/1000th the energy of those of the loud bats. Although these sounds probably suffice for orientation with respect to large stationary objects such as vegetation, they are not suitable for echo ranging on small moving targets. Some species within each group diverge from the acoustic pattern generally characteristic of the group. Such variations have been found to be accompanied by important differences in habits.

Biological sonar systems are not restricted solely to bats, and Griffin describes a relatively simple case of orientation by means of mechanical vibrations in the familiar whirligig beetle and presents the evidence for echolocation among fishes and cetaceans. Of particular interest to the ornithologist is the consideration of acoustic orientation in birds. The first species of bird to be added to the list of animals employing echolocation systems was the neotropical Oilbird or Guácharo, *Steatornis caripensis*. An early account of these birds in the Cave of the Guácharos in the Caripe valley, Venezuela, by Alexander von Humboldt emphasized the facts that they frequented dark recesses and were particularly vociferous. In 1953 Griffin visited the Cave of the Guácharos at Caripe with some of the apparatus used to study bat sounds to investigate the possibility of echolocation in the Oilbirds. Initial observations deep in the cave during the day confirmed that the birds did indeed fly in total darkness, but the weird assortment of sounds that was heard gave no clear evidence that the birds were using echolocation. However, observations on the evening flight of the birds from the cave found them emitting only a single kind of sound—a very sharp click. The duration of the pulse is only about 1 to 1.5 milliseconds, in this respect being comparable to bat pulses, but its frequency lies well within the range of human hearing, averaging only about 7,000 c.p.s. Further experiments with captive Oilbirds in an improvised laboratory demonstrated their disorientation when forced to fly in the dark with the ears plugged, whereas their flight was normal when flying in a lighted room with plugged ears.

Observations on the behavior of cave-inhabiting swifts *(Collocalia)* of southeast Asia have strongly suggested that they, too, employ echolocation, and recent preliminary experiments performed on *Collocalia brevirostris* in Ceylon add further confirmation to this hypothesis. The possibility that still other species of nocturnal birds may utilize echolocation should certainly stimulate further investigations of this aspect of bird behavior.

Echolocation is not without significance to mankind. Griffin discusses the pioneer studies of Dallenbach and his associates at Cornell which conclusively demonstrated that acoustic orientation was the basis of the so-called "facial vision" by which blind men are able to detect obstacles in their path and the artificial systems that have been developed for human echolocation. He points out that although many of the military and commercial applications of sonar and radar devices have been realized, much of their potential is yet to be exploited. The possibility of utilizing mechanical vibrations instead of x-rays for medical diagnosis is merely one example of future applications of these principles.

In closing his account of echolocation among animals, the author states his conviction that in this era of science the richest rewards in the study of functional natural history are to be gained through the rigorous use of the experimental method. This book should stand along with such works as Von Frisch's on the language of the bees as a classic example of the value of such an approach to the study of living organisms—James N. Layne.

69. The Birds. Oskar and Katharina Heinroth. 1958. University of Michigan Press. Ann Arbor, Mich. 181 pp. $5.00. Twenty years ago I reviewed Oskar Heinroth's "*Aus dem Leben der Vögel*" *(Bird-Banding,* **9**(3): 171) with this concluding sentence: "This little book is so full of sane, illuminating wisdom that its translation into English would be a boon to the bird students of England and America." This has now come true—a translation by Michael Cullen of a second, enlarged edition that appeared in 1955 with additions by Dr. Heinroth's second wife and changes of some of the illustrations.

From the years Oscar and his first wife, Magdalena spent in hand-raising most of the species of central Europe, and from his experience with exotic birds in the Berlin Zoo, he wrote a book that is a mine of information on the biology of birds. He tells us: "there is no such animal as The Bird . . . The experienced ornithologist is astonished by the many different ways in which different species solve a particular problem, each in accordance with its own structure and habits and each in a more or less unvarying and instinctive way."

A few statements are in error: "In geese and swans . . . the male shares the incubation of the eggs" (the word "seldom" should have been inserted). The Emperor Penguin is said to incubate as long as 15 days at a stretch (recent studies have shown that the male incubates for 9 weeks). As to ducks pairing in winter quarters, "it may happen that a female from England follows her new

husband to Siberia, or vice versa" (in reality it is the drake that follows the hen to her home).

There is an index of species giving scientific names and page citations, but no references. Mr. Cullen has been most successful in translating this book that will be of value both to the serious student and to the beginner.—M. M. Nice.

70. Observations on Birds of Southeastern Brazil. Margaret H. Mitchell. 1957. University of Toronto Press. pp. i-x, 1-258. Price $5.50. Mrs. Mitchell has written a pleasant, readable book about her birding experiences during her 4-year stay in Brazil. Much more than a bird-watcher's diary, it contains a great deal of worthwhile material, particularly on the habits and behavior of unmistakable species. Its core is the annotated list of the 289 species of birds she "identified positively" of the perhaps 2,000 species occurring in Brazil.

I am much impressed by the author's success in familiarizing herself with a new and strange avifauna without recourse to collecting. She studied the birds carefully afield, made copious notes on the spot, and made good use of the excellent skin collection in Rio de Janiero to identify what she saw. She also studied the literature thoroughly, as the extensive bibliography and her constant references to it prove. For a non-systematist she has handled the nomenclature well, largely by following Hellmayr *et al* for both scientific and English names. Not least of her contributions is the close attention she paid to local vernacular names and their origin and meaning.

I have the greatest respect for the author's ability in field identification as shown by her writing. I do not for one moment question her integrity, and I am most favorably impressed by her conservatism and her frankness in admitting her inability to identify many of the birds she saw. Nevertheless, the question of identification is always present in a work based entirely on sight observation, and it doesn't help matters one bit to include uncertainties under such headings as "Terns sp.?", "Small Sandpipers sp.?", "*Limnodromus* sp. Dowitcher," and "*Himantopus*, sp. Stilt." Identifying birds positively at a distance on the grounds that they couldn't be anything else, as she apparently does with the Brown Pintail, the Dowitchers, Stilts, and Cabot's Tern among others, can always be suspect, and omitting all such uncertainties would have strengthened the book. The careful student of status and distribution is forced to reject them, and they just clutter up the literature.—O. L. Austin, Jr.

71. Birds of Maryland and the District of Columbia. Robert E. Stewart and Chandler S. Robbins. 1958. North American Fauna, No. 62. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D. C. vi + 401 pp., 1 plate, 69 maps, paperbound. Price $1.75. This is the first full-scale treatment of the birds of Maryland since 1895, and the most detailed treatment of the birds of the District of Columbia. It is based in part on intensive field work by the authors since 1941. Compared to other recent "state books", it is strong in the use of banding data and breeding bird censuses, with excellent distributional and migration maps.

Species have been admitted to the regular list on a conservative basis, "if any one of three prerequisites is satisfied: (1) a specimen preserved; (2) a satisfactory photograph taken; or (3) three or more reliable sight observations made." Obviously, difficulty in identifying certain species has been given weight; e.g. the Great [formerly European] Cormorant is kept on the hypothetical list despite four sight records listed.

Stewart and Robbins have given us an admirable example to support the belief that what a "state book" needs most is a solid text and an abundance of maps. While some first-rate books have used good color plates to advantage, color plates—good or bad—have been used too often to cover up the drawbacks of a tired text.—E. Alexander Bergstrom.

AUSTIN STATION SAVED

We record with great pleasure the purchase of the buildings and land (300 acres) of the world-famous O. L. Austin Ornithological Research Station (North Eastham, Mass.) by the Massachusetts Audubon Society.

Upon the death of Dr. Oliver L. Austin, Senior, in 1957 *(Bird-Banding,* **29:** 71), the station formed part of the estate left to his widow. It appeared that the station would have to be sold for real estate development; however, the Society, under Allen H. Morgan, Executive Vice-President, raised enough money to buy the premises, and is now endeavoring to raise endowment. They hope to operate a multi-purpose demonstration wildlife sanctuary, with special emphasis on research.

As this issue goes to press, it is not known whether the Society can raise funds in time to have the station in full operation by the summer of 1959.

We are therefore inviting contributions to the Northeastern Bird-Banding Association, for a new Research Fund. Its first objective is $1,000, to ensure continuity in the field work with adult terns, in the 1959 season. This will cover salary and expenses of two or three men for the short season during which the adults can be trapped. The work is hard, with long hours, and volunteer efforts are not enough to cover the ground. A regular staff does, however, furnish an excellent nucleus around which the efforts of volunteers can be planned.

We think that contributions to this fund will give unusually high returns:

(a) a high proportion of the adult terns carry bands (the AORS banded over 650,000 Common Terns), so that trapping yields data of immediate value;
(b) the regular staff will be housed at the station, with no charge for rent;
(c) the NEBBA has no overhead expenses to be paid out of the fund, and
(d) we expect to hire college students who will find the work of interest professionally, and be earning part of their expenses for the coming college year.

If you would like to help, please mail your contribution *now* to NEBBA's Treasurer, Mr. Hugh E. Harlow, 47 Scotland Road, Reading, Mass., designated for this fund. Such contributions are deductible from income subject to tax.

NOTES AND NEWS

At a meeting in New York City on October 15, 1958 (in conjunction with the A.O.U. meeting), delegates of the four regional bird-banding associations voted to form a new Council of North American Bird-Banding Organizations. Its purpose is not to replace the existing associations, but to set up some simple machinery to make it easier for them to cooperate on projects and problems common to all.

Mrs. John Y. Dater, Jr. (259 Grove St., Ramsey, N. J.), first vice-president of the Eastern Bird-Banding Association, was elected as chairman for a term expiring with the 1959 A.O.U. meeting. Mr. E. Alexander Bergstrom was named chairman of a committee to work on the pending revision of the bird-banding manual, in cooperation with the Fish and Wildlife Service.

At the annual meeting of the Northeastern Bird-Banding Association, Roland C. Clement was unwilling to be renominated as Treasurer because of extreme pressure of other work. During the past year, Roland supervised the moving of the R. I. Audubon Society to new quarters, started a new periodical for the Society, made a month's trip to Labrador for the Carnegie Museum, and took up an appointment on the staff of the National Audubon Society in New York. Elected Treasurer in his place was Hugh E. Harlow (47 Scotland Road, Reading, Mass.), who is a staff associate (specializing in electronics) with Anderson, Nichols and Company, consulting engineers.

Also at the NEBBA annual meeting, a committee (under Richard J. Eaton as chairman) was appointed to study incorporation of the association, and revision of its by-laws.

Dr. Charles H. Huntington, Assistant Professor of Biology at Bowdoin and a member of the NEBBA's council, recently received a five-year grant from the National Science Foundation to study Leach's Petrels at Kent Island, N. B.

Applications for grants for ornithological research from the Frank M. Chapman Memorial Fund should be received by March 15, by the Frank M. Chapman Memorial Committee, The American Museum of Natural History, Central Park West at 79th St., New York 24, N. Y.

Students of bird migration will find good news in the fact that Dr. David Lack has (in his words) "switched my own research to migration." It would be greatly appreciated if reprints of migration papers and notes might be sent to Dr. Lack, at the Edward Grey Institute of Field Ornithology, Botanic Gardens, Oxford, England.

Oscar M. Root's excellent paper on "The Birds of the Andover Region" (Mass.) (reviewed in *Bird-Banding*, **29:** 201) is now available from the author, at Brooks School, North Andover, Mass., at $1.00 a copy, postpaid.

Despite an active demand, the NEBBA is succeeding quite well in keeping three sizes of mist nets in stock for immediate delivery. For details, write to E. Alexander Bergstrom, 37 Old Brook Road, West Hartford 7, Conn.

Erratum: in **29:** 153 (July, 1958), first line, for "1900" read "0900 (D.S.T.)".

We regret the unusual number of mailing errors in recent issues, and have taken steps to reduce them. If any subscriber has not called a missing copy to our attention, please let Mr. Harlow know so that it may be replaced.

BIRD-BANDING

A JOURNAL OF ORNITHOLOGICAL INVESTIGATION

Published quarterly for:

THE NORTHEASTERN BIRD-BANDING ASSOCIATION
THE EASTERN BIRD-BANDING ASSOCIATION
THE INLAND BIRD-BANDING ASSOCIATION

Applications for membership in these associations should be sent to their respective secretaries. The annual membership dues of $5 per year ($7 family membership, for adults) in the Northeastern Association include a subscription to *Bird-Banding*. Membership in the Eastern and Inland Associations is $2 each per year; members of those associations who wish to receive *Bird-Banding* may send $4 direct to the secretary-treasurer. Subscription price to non-members of the associations is $5 per year; single copy $1.25.

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